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The

Works of George Berkeley

Vol. III

HENRY FROWDE, M.A.
PUBLISHER TO THE UNIVERSITY OF OXFORD
LONDON, EDINBURGH
NEW YORK

The

Works of George Berkeley

D.D.; Formerly Bishop of Cloyne

Including his Posthumous Works

With Prefaces, Annotations, Appendices, and
An Account of his Life, by

Alexander Campbell Fraser

Hon. D.C.L. Oxford

Hon. LL.D. Glasgow and Edinburgh; Emeritus Professor
of Logic and Metaphysics in the University of Edinburgh

In Four Volumes

Vol. III: Philosophical Works, 1734-52

Oxford

At the Clarendon Press

mdcccci

OXFORD
PRINTED AT THE CLARENDON PRESS
BY HORACE HART, M.A.
PRINTER TO THE UNIVERSITY

PRINTED IN ENGLAND

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THE ANALYST

OR, A DISCOURSE ADDRESSED TO AN INFIDEL MATHEMATICIAN

WHEREIN IT IS EXAMINED WHETHER THE OBJECT, PRINCIPLES, AND INFERENCES OF THE MODERN ANALYSIS ARE MORE DISTINCTLY CONCEIVED, OR MORE EVIDENTLY DEDUCED, THAN RELIGIOUS MYSTERIES AND POINTS OF FAITH

BY THE AUTHOR OF

The Minute Philosopher

'First cast out the beam out of thine own eye; and then shalt thou see clearly to cast out the mote out of thy brother's eye.'—
MATT. c. vii. v. 5

First published in 1734

EDITOR'S PREFACE

TO

THE ANALYST

THE *Analyst* was published in 1734, in Dublin and in London, when its author was leaving London to take possession of the remote bishopric of Cloyne, after a stay of two years in England, following his return from Rhode Island. He was still engaged with the minute philosophers when he returned to Ireland; and *Alciphron* had evoked the criticisms of theologians and orthodox thinkers as well as of religious sceptics. In April, 1734, he tells his friend Samuel Johnson in Connecticut, that 'as to the Bishop of Cork's (Browne) book[1], and the other book you allude to, the author whereof is one Baxter[2], they are both very little read and considered here; for which reason I have taken no public notice of them. To answer objections already answered, and repeat the same things, is a needless as well as disagreeable task. Nor should I have taken notice of that Letter about Vision[3], had it not been printed in a newspaper, which spread it through the kingdom. Beside, the Theory of

[1] Bishop Browne's *Divine Analogy*, published in 1733. The eighth chapter contains a defence of Browne's 'analogical knowledge' of God, against the objections proposed in *Alciphron*.

[2] He refers to Andrew Baxter, a Scotchman, author of an *Inquiry into the Nature of the Human Soul* (1734), one section in which is entitled—'Dean Berkeley's scheme against the existence of Matter, or a material world, examined and shewn inconclusive.'

[3] See Editor's Preface to *Visual Language Vindicated*.

Vision I found was somewhat obscure to most people; for which reason I was not displeased at an opportunity to explain it[1].'

But Berkeley's 'minute philosopher' now appears as a sceptical mathematician. Early in 1734, he thus refers to his health and engagements, in a letter to his friend Prior:—'As to myself, by regular living, and rising very early (which I find the best thing in the world), I am very much mended; insomuch that though I cannot read, yet my thoughts seem as distinct as ever. I do, therefore, for amusement, pass my early hours in thinking of certain mathematical matters, which may possibly produce something[2].' The *Analyst* was the result.

His *Commonplace Book* shews that his thoughts were even then working in this direction; more distinctly afterwards in the *Principles* and the *De Motu*. Andrew Baxter, in his *Inquiry*, urges as an objection to Berkeley's new conception of matter and space, that it forced those who accept it 'to suspect that even mathematics may not be very sound at the bottom.' Stock tells that Addison was connected with Berkeley's crusade against mathematical free-thinkers, inasmuch as he had told him that Garth, in his last illness, was impervious to Christianity, on the ground that Edmund Halley, the famous mathematician and astronomer, had convinced him that this religion was an imposture; because its professed revelation of God was incomprehensible. However this may be, Berkeley's thoughts during this spring in London, and afterwards at Cloyne, turned upon a phase of 'minute philosophy' supposed to be common among mathematicians, founded on the existence of mysteries in religion.

The *Analyst* is addressed to Edmund Halley (1646–1742), the famous astronomer, in the character of 'an infidel mathematician.' In science Halley ranked next

[1] See my *Life and Letters of Berkeley* (1871), p. 222.
[2] *Ibid.*, p. 210.

to Newton by the consent of his contemporaries, and there is no proof of religious scepticism in his published writings. His 'infidelity' rests upon common repute, and private expressions of opinion, like the alleged atheistic 'demonstration' of Anthony Collins; all which Berkeley was perhaps rashly apt to proceed upon. But his suspected materialism had deprived Halley of the support of Stillingfleet, when he was a candidate for the Savilian chair of Geometry at Oxford along with David Gregory. And we are told[1] that Newton checked him, when he spoke in disparagement of religion, by the mild reproof—'I have studied these things: you have not.' The question is discussed in a *Defence of Halley against the charge of Religious Infidelity* (1844), by the Rev. S. J. Rigaud of Ipswich.

The philosophical and theological aim of the *Analyst*, apart from the mathematical discussions to which it led, is apt to be confused with the purely mathematical controversy. In Berkeley's mind it is an *argumentum ad hominem* as against free-thinking mathematicians, in continuation, too, of the leading argument in the Seventh Dialogue of *Alciphron*. Certain mathematicians reject religion, on the ground of its ultimate incomprehensibility: yet their own science is ultimately incomprehensible; and indeed some of its doctrines rest on reasonings which seem incoherent, if not contradictory. Mathematics, like all other human knowledge, is sustained only by the faith or trust which is indispensable in the absence of omniscience. Religion necessarily shares in this ultimate incomprehensibility, common to it with the most demonstrable portion of human knowledge.

A like argument appears in the Seventh Dialogue of *Alciphron*, and is approached in the Introduction to the *Principles* (sect. 20), where it is maintained that words need not always signify ideas: without ideas they may express

[1] Brewster's *Life of Newton*.

practical rules sufficient for us to act by. At the root of all human knowledge, there are working principles which cannot be reduced to our ideas: it is unreasonable to insist on so resolving them. In this respect science and religion are upon the same footing. *Force* is as incomprehensible as *grace*. Both have a practical meaning; but neither of the meanings can be fully exhibited in our ideas of sense or imagination. So, too, with the 'infidel mathematician.' He objects to religion because God cannot be fully represented in a sensuous image: he ought equally to reject mathematics because it too is rooted in like mystery.

Newton's method of fluxions, then so much in vogue, is taken as the example. Fluxions are unrepresentable in imagination: we cannot realise them in ideas of sense; and the demonstrations which support them, useful in the results, are humanly incomprehensible at last. Yet mathematical 'free-thinkers' are found ready to accept within their own science what they reject in religion: fluxions, like religion, when resolved into ultimate principles, involve incompleted or mysterious conceptions which transcend human understanding: and 'infidel mathematicians' receive them, trusting to the authority of incompletely comprehended principles, some infidels on the personal authority of Sir Isaac Newton.

In his criticism of the rationale of fluxions, Berkeley doubtless touched controvertible points in the Newtonian theory. De Morgan, in his essay on *The Early History of Infinitesimals in England*, says that Newton's doctrine differed at different periods; that before 1704 he treated of infinitely small quantities; that in that year, in his *Quadratura Curvarum*, he renounced infinitely small quantity, and in a way apt to suggest that he had never accepted it. De Morgan further holds that Berkeley in the *Analyst*, could not, or would not, see that the Newton of 1687 and the Newton of 1704 were of two different

modes of thought; and that he puts the infinitely small moments of the *Principia* against contradictory declarations in the *Quadratura*.

In this congenial field Berkeley shews his characteristic subtlety. He boldly challenges the modern analysts; argues that mathematicians are obliged in their demonstrations to assume what cannot be resolved into finite objects of sense; and concludes that reasoners who can accept mysteries in their own province are inconsistent in rejecting religion, because it makes a like demand upon imperfectly conceivable trust. All human knowledge, physical, mathematical, and theological, is thus, in the last resort, practical faith, rather than perfectly conceived science.

It may be allowed that Berkeley's natural impetuosity, and disposition to push conceptions to extremes, leads him in the *Analyst* to positions that are at least apt to be misunderstood. Not contented with pressing the incomprehensibility, if not the contradictiveness, of the foundations of mathematics, especially of fluxions, he attributes fallacies to the Newtonian analysis. He speaks as if fluxions involved positive contradictions, and not merely relative incomprehensibility; and mathematicians complain that he was blind to the Newtonian conception of continuity. But he was arguing with persons who were supposed to assume that words must signify what is resolvable into data of sense, and who rejected the mysteries of religion because they were not thus analysable, except at the expense of a contradiction. He seems to regard the Newtonian conception of continuity as open to a like objection, at the same point of view; as incapable of reduction to data of sense and imagination, accordingly involving contradictions when dealt with as if it were. If this is all he meant, his language is unguarded. Carnot and Lagrange, Euler and D'Alambert, afterwards tried by various expedients to resolve difficulties similar to some of those which Berkeley brought to light.

Berkeley makes much of the mysteries involved in *quantitative infinity* in mathematics: one might have expected him to make a reference to the mystery of *endless life* in religion; which, moreover, involves qualitative as well as quantitative incomprehensibility. A life prolonged for millions of years multiplied by millions is still finite, and therefore comprehensible, thus differing from life that is absolutely endless; and 'eye hath not seen, nor ear heard, neither hath it entered into the heart of man to conceive' a life released from the physical conditions of mortal life on earth. The sensuous imagination cannot produce a *picture* of immortality, and yet the *word* has been the medium of a stupendous influence in the spiritual history of man. It is a signal example of what Berkeley intends, when he says that 'the communicating of ideas is not the chief and only end of language, as is commonly supposed'; for it has other ends, 'as the raising of some passion, the exciting to or deterring from an action, the putting the mind in some particular disposition'; so that 'the passions of fear, love, hatred, admiration, disdain, and the like, arise immediately in the mind upon the perception of certain words, without any ideas coming between.'

The appearance of the *Analyst* with its metaphysics was the signal for a mathematical controversy, memorable in the history of the science in England in the eighteenth century. In the seven years that followed its appearance nearly thirty pamphlets and articles were issued in attack or defence, some of the chief mathematicians of the time taking part in the fray.

Foremost among them was Dr. James Jurin (1684–1750) of Cambridge, the eminent physician and physicist, an intimate friend of Newton, who attacked the *Analyst* soon after it appeared, under the pseudonym of *Philalethes Cantabrigiensis*, in a pamphlet entitled, *Geometry no friend to*

Infidelity; *or a Defence of Sir Isaac Newton and the British Mathematicians. In a letter to the author of the Analyst.* Berkeley's *Defence of Free-thinking in Mathematics*, published in March, 1735, is his reply to Jurin. There was a rejoinder by *Philalethes Cantabrigiensis*, in the *Minute Mathematician; or the Free-thinker no Just thinker, set forth in a Second Letter to the Author of the Analyst; containing a Defence of Sir Isaac Newton and the British Mathematicians against a late Pamphlet entitled 'A Defence of Free-thinking in Mathematics.'* To this *Second Letter*, dated June 13, 1735, and published in the following month, Berkeley made no reply.

In the same year, Walton of Dublin offered a *Vindication of Sir Isaac Newton's Fluxions.* To this Berkeley replied in an *Appendix* to the Second Edition of his *Defence of Free-thinking in Mathematics*, an *Appendix* which ends in a series of questions. Walton's rejoinder is entitled *The Catechism of the Author of the Minute Philosopher fully answered.* This answer drew from Berkeley his *Reasons for not replying to Mr. Walton's Full Answer, in a Letter to O. T. P.* To this Walton responded in an *Answer to the Reasons for not replying to Mr. Walton's Full Answer*, appended to a second edition of his *Catechism.* With this the controversy between Berkeley and Walton ended.

The discussion was continued for some years among the mathematicians, becoming more exclusively mathematical, to the neglect of the metaphysical argument which was the motive of the *Analyst.* The following are among the more important of the relative publications:—

A Discourse concerning the Nature and Certainty of Sir Isaac Newton's Methods of Fluxions, and of Prime and Ultimate Ratios, by Benjamin Robins. Robins (1707–51) was a distinguished mathematician, who had been shortly before in controversy with Bernorelli about Leibniz's conception of motion. On returning from abroad he

found English mathematicians eagerly engaged in the discussion which the *Analyst* had raised. His *Discourse*, which appeared in 1735, was followed in 1739 by his *Remarks on M. Euler's Treatise of Motion; on the compleat System of Optics by Dr. Smith, Master of Trinity College, Cambridge; and on Dr. Jurin's Discourse of distinct and indistinct Vision*; thus connected with the theory of Vision. The *Discourse* of 1735 was reviewed in the *Republic of Letters* of September in that year. In the December number there is a criticism by Robins of the 'objections to the doctrine of fluxions and ultimate proportions; with remarks on methods taken to obviate them.' The controversy was continued in a series of articles by Robins and Jurin which appeared in the *Republic of Letters* in January, April, July, and August, 1736. Henry Pemberton (1694–1771), the physician, a friend of Newton, who employed him to superintend the third edition of the *Principia* (1726), likewise engaged in the controversy. A series of nine articles and rejoinders between Pemberton and Jurin appeared in the *Works of the Learned* in 1737, from February onwards.

In 1736 the Rev. Thomas Bayes(?) published an *Introduction to the Doctrine of Fluxions, and Defence of the Mathematicians against the objections of the Author of the Analyst; so far as they are designed to affect the several Methods of Reasoning.* In the following year James Smith produced *A New Treatise on Fluxions*; and an anonymous *Explanation of Fluxions* was published in 1741. In 1745 appeared *The Harmony of the Ancient and Modern Geometry asserted: in Answer to the Call of the Author of the Analyst upon the celebrated Mathematicians of the present age, to clear up what he styles their obscure analytics.* This forgotten tract consists of papers presented to the Royal Society, treating fluxions as a branch of a more general method of reasoning called *maximinority* and *minimajority.* In 1739 Robins had published *Remarks on Euler, Smith, and*

Jurin, to which Jurin replied in the same year. A rejoinder by Robins in 1740 drew an *Answer* from Jurin in the following year. In 1742 Colin Maclaurin, the celebrated Scottish mathematician, published an elaborate *Treatise on Fluxions*. All these are examples of the voluminous controversy of which the *Analyst* was the parent. 'The *Analyst*,' according to Professor Kelland, 'did good service to science, if in no other way, by giving occasion to the work of Maclaurin on Fluxions. The principles of the method had been previously exhibited in a concise and obscure manner: he developed them after the manner of the ancient geometers.'

Berkeley refers to the *Analyst* controversy in *Siris* (sect. 271, note), which may be taken as his last word on the subject. The mathematical importance of the *Analyst* is less than its metaphysical, or than its biographical and historical significance.

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THE ANALYST

A DISCOURSE ADDRESSED TO AN INFIDEL MATHEMATICIAN

1. THOUGH I am a stranger to your person, yet I am not, Sir, a stranger to the reputation you have acquired in that branch of learning which hath been your peculiar study; nor to the authority that you therefore assume in things foreign to your profession; nor to the abuse that you, and too many more of the like character, are known to make of such undue authority, to the misleading of unwary persons in matters of the highest concernment, and whereof your mathematical knowledge can by no means qualify you to be a competent judge. Equity indeed and good sense would incline one to disregard the judgment of men, in points which they have not considered or examined. But several who make the loudest claim to those qualities do nevertheless the very thing they would seem to despise, clothing themselves in the livery of other men's opinions, and putting on a general deference for the judgment of you, Gentlemen, who are presumed to be of all men the greatest masters of reason, to be most conversant about distinct ideas, and never to take things upon trust, but always clearly to see your way, as men whose constant employment is the deducing truth by the justest inference from the most evident principles. With this bias on their minds, they submit to your decisions where you have no right to decide. And that this is one short way of making Infidels, I am credibly informed.

2. Whereas then it is supposed that you apprehend more distinctly, consider more closely, infer more justly, and

conclude more accurately than other men, and that you are therefore less religious because more judicious, I shall claim the privilege of a Free-thinker; and take the liberty to inquire into the object, principles, and method of demonstration admitted by the mathematicians of the present age, with the same freedom that you presume to treat the principles and mysteries of Religion; to the end that all men may see what right you have to lead, or what encouragement others have to follow you. It hath been an old remark, that Geometry is an excellent Logic. And it must be owned that when the definitions are clear; when the postulata cannot be refused, nor the axioms denied; when from the distinct contemplation and comparison of figures, their properties are derived, by a perpetual well-connected chain of consequences, the objects being still kept in view, and the attention ever fixed upon them; there is acquired a habit of reasoning, close and exact and methodical—which habit strengthens and sharpens the mind, and being transferred to other subjects is of general use in the inquiry after truth. But how far this is the case of our geometrical analysts, it may be worth while to consider.

3. The Method of Fluxions is the general key by help whereof the modern mathematicians unlock the secrets of Geometry, and consequently of Nature. And, as it is that which hath enabled them so remarkably to outgo the ancients in discovering theorems and solving problems, the exercise and application thereof is become the main if not sole employment of all those who in this age pass for profound geometers. But whether this method be clear or obscure, consistent or repugnant, demonstrative or precarious, as I shall inquire with the utmost impartiality, so I submit my inquiry to your own judgment, and that of every candid reader.—Lines are supposed to be generated[1] by the motion of points, planes by the motion of lines, and solids by the motion of planes. And

[1] [*Introd. ad Quadraturam Curvarum.*]—AUTHOR. In this and the three following sections, we have a summary of mysteries involved in the Newtonian fluxions, and also in the *Calculus* of the continental mathematicians, which are alleged to make no less demand on final faith than the mysteries that religion involves.

whereas quantities generated in equal times are greater or lesser according to the greater or lesser velocity wherewith they increase and are generated, a method hath been found to determine quantities from the velocities of their generating motions. And such velocities are called fluxions: and the quantities generated are called flowing quantities. These fluxions are said to be nearly as the increments of the flowing quantities, generated in the least equal particles of time; and to be accurately in the first proportion of the nascent, or in the last of the evanescent increments. Sometimes, instead of velocities, the momentaneous increments or decrements of undetermined flowing quantities are considered, under the appellation of moments.

4. By moments we are not to understand finite particles. These are said not to be moments, but quantities generated from moments, which last are only the nascent principles of finite quantities. It is said that the minutest errors are not to be neglected in mathematics: that the fluxions are celerities, not proportional to the finite increments, though ever so small; but only to the moments or nascent increments, whereof the proportion alone, and not the magnitude, is considered. And of the aforesaid fluxions there be other fluxions, which fluxions of fluxions are called second fluxions. And the fluxions of these second fluxions are called third fluxions: and so on, fourth, fifth, sixth, &c. *ad infinitum*. Now, as our Sense is strained and puzzled with the perception of objects extremely minute, even so the Imagination, which faculty derives from sense, is very much strained and puzzled to frame clear ideas of the least particles of time, or the least increments generated therein: and much more so to comprehend the moments, or those increments of the flowing quantities in *statu nascenti*, in their very first origin or beginning to exist, before they become finite particles. And it seems still more difficult to conceive the abstracted velocities of such nascent imperfect entities. But the velocities of the velocities—the second, third, fourth, and fifth velocities, &c.—exceed, if I mistake not, all human understanding. The further the mind analyseth and pursueth these fugitive ideas the more it is lost and bewildered; the objects, at first fleeting and minute, soon vanishing out of sight. Certainly, in any sense, a second

or third fluxion seems an obscure Mystery. The incipient celerity of an incipient celerity, the nascent augment of a nascent augment, i. e. of a thing which hath no magnitude—take it in what light you please, the clear conception of it will, if I mistake not, be found impossible; whether it be so or no I appeal to the trial of every thinking reader. And if a second fluxion be inconceivable, what are we to think of third, fourth, fifth fluxions, and so on without end?

5. The foreign mathematicians are supposed by some, even of our own, to proceed in a manner less accurate, perhaps, and geometrical, yet more intelligible. Instead of flowing quantities and their fluxions, they consider the variable finite quantities as increasing or diminishing by the continual addition or subduction of infinitely small quantities. Instead of the velocities wherewith increments are generated, they consider the increments or decrements themselves, which they call differences, and which are supposed to be infinitely small. The difference of a line is an infinitely little line; of a plane an infinitely little plane. They suppose finite quantities to consist of parts infinitely little, and curves to be polygons, whereof the sides are infinitely little, which by the angles they make one with another determine the curvity of the line. Now to conceive a quantity infinitely small—that is, infinitely less than any sensible or imaginable quantity, or any the least finite magnitude—is, I confess, above my capacity. But to conceive a part of such infinitely small quantity that shall be still infinitely less than it, and consequently though multiplied infinitely shall never equal the minutest finite quantity, is, I suspect, an infinite difficulty to any man whatsoever; and will be allowed such by those who candidly say what they think; provided they really think and reflect, and do not take things upon trust.

6. And yet in the *calculus differentialis*, which method serves to all the same intents and ends with that of fluxions, our modern analysts are not content to consider only the differences of finite quantities: they also consider the differences of those differences, and the differences of the differences of the first differences: and so on *ad infinitum*. That is, they consider quantities infinitely less than the least discernible quantity; and others infinitely less than those infinitely small ones; and still others infinitely

less than the preceding infinitesimals, and so on without end or limit. Insomuch that we are to admit an infinite succession of infinitesimals, each infinitely less than the foregoing, and infinitely greater than the following. As there are first, second, third, fourth, fifth, &c. fluxions, so there are differences, first, second, third, fourth, &c. in an infinite progression towards nothing, which you still approach and never arrive at. And (which is most strange) although you should take a million of millions of these infinitesimals, each whereof is supposed infinitely greater than some other real magnitude, and add them to the least given quantity, it shall never be the bigger. For this is one of the modest *postulata* of our modern mathematicians, and is a corner-stone or ground-work of their speculations.

7. All these points, I say, are supposed and believed by certain rigorous exactors of evidence in religion, men who pretend to believe no further than they can see. That men who have been conversant only about clear points should with difficulty admit obscure ones might not seem altogether unaccountable. But he who can digest a second or third fluxion, a second or third difference, need not, methinks, be squeamish about any point in divinity. There is a natural presumption that men's faculties are made alike. It is on this supposition that they attempt to argue and convince one another. What therefore shall appear evidently impossible and repugnant to one may be presumed the same to another. But with what appearance of reason shall any man presume to say that mysteries may not be objects of faith, at the same time that he himself admits such obscure mysteries to be the object of science[1]?

8. It must indeed be acknowledged the modern mathematicians do not consider these points as mysteries, but as clearly conceived and mastered by their comprehensive minds. They scruple not to say that by the help of these new analytics they can penetrate into infinity itself: that they can even extend their views beyond infinity: that their art comprehends not only infinite, but infinite of

[1] 'Objects of science,' i. e. objects of the *faith*, or intelligent trust, which is at the root of mathematical and physical science, as it is also at the root of religion and theology.

infinite (as they express it), or an infinity of infinites. But, notwithstanding all these assertions and pretensions, it may be justly questioned whether, as other men in other inquiries are often deceived by words or terms, so they likewise are not wonderfully deceived and deluded by their own peculiar signs, symbols, or species. Nothing is easier than to devise expressions or notations for fluxions and infinitesimals of the first, second, third, fourth, and subsequent orders, proceeding in the same regular form without end or limit $x.\ \dot{x}.\ \ddot{x}.\ \dddot{x}.$ &c. or *dx. ddx. dddx. ddddx. &c.* These expressions, indeed, are clear and distinct, and the mind finds no difficulty in conceiving them to be continued beyond any assignable bounds. But if we remove the veil and look underneath, if, laying aside the expressions, we set ourselves attentively to consider the things themselves which are supposed to be expressed or marked thereby, we shall discover much emptiness, darkness, and confusion; nay, if I mistake not, direct impossibilities and contradictions. Whether this be the case or no, every thinking reader is entreated to examine and judge for himself.

9. Having considered the object, I proceed to consider the principles of this new analysis by momentums, fluxions, or infinitesimals; wherein if it shall appear that your capital points, upon which the rest are supposed to depend, include error and false reasoning; it will then follow that you, who are at a loss to conduct yourselves, cannot with any decency set up for guides to other men. The main point in the method of fluxions is to obtain the fluxion or momentum of the rectangle or product of two intermediate quantities. Inasmuch as from thence are derived rules for obtaining the fluxions of all other products and powers; be the coefficients or the indexes what they will, integers or fractions, rational or surd. Now, this fundamental point one would think should be very clearly made out, considering how much is built upon it, and that its influence extends throughout the whole analysis. But let the reader judge. This is given for demonstration [1]. Suppose

[1] *Philosophiæ Naturalis Principia Mathematica*, Lib. II. lem. 2.]—AUTHOR.

the product or rectangle $A B$ increased by continual motion: and that the momentaneous increments of the sides A and B are a and b. When the sides A and B were deficient, or lesser by one half of their moments, the rectangle was $\overline{A-\frac{1}{2}a} \times \overline{B-\frac{1}{2}b}$, i. e. $AB-\frac{1}{2}aB-\frac{1}{2}bA+\frac{1}{4}ab$. And as soon as the sides A and B are increased by the other two halves of their moments, the rectangle becomes $\overline{A+\frac{1}{2}a} \times \overline{B+\frac{1}{2}b}$ or $AB+\frac{1}{2}aB+\frac{1}{2}bA+\frac{1}{4}ab$. From the latter rectangle subduct the former, and the remaining difference will be $aB+bA$. Therefore the increment of the rectangle generated by the entire increments a and b is $aB+bA$. *Q.E.D.* But it is plain that the direct and true method to obtain the moment or increment of the rectangle AB, is to take the sides as increased by their whole increments, and so multiply them together, $A+a$ by $B+b$, the product whereof $AB+aB+bA+ab$ is the augmented rectangle; whence, if we subduct AB the remainder $aB+bA+ab$ will be the true increment of the rectangle, exceeding that which was obtained by the former illegitimate and indirect method by the quantity ab. And this holds universally by the quantities a and b be what they will, big or little, finite or infinitesimal, increments, moments, or velocities. Nor will it avail to say that ab is a quantity exceeding small: since we are told that *in rebus mathematicis errores quam minimi non sunt contemnendi.*

10. [1] Such reasoning as this for demonstration, nothing but the obscurity of the subject could have encouraged or induced the great author of the fluxionary method to put upon his followers, and nothing but an implicit deference to authority could move them to admit. The case indeed is difficult. There can be nothing done till you have got rid of the quantity ab. In order to this the notion of fluxions is shifted: it is placed in various lights: points which should be clear as first principles are puzzled; and terms which should be steadily used are ambiguous. But, notwithstanding all this address and skill, the point of getting rid of ab cannot be obtained by legitimate reasoning. If a man, by methods not geometrical or demonstrative, shall have satisfied himself of the usefulness of certain rules; which he afterwards shall propose to his disciples

[1] [*Introd. ad Quadraturam Curvarum.*]—AUTHOR.

for undoubted truths; which he undertakes to demonstrate in a subtle manner, and by the help of nice and intricate notions; it is not hard to conceive that such his disciples may, to save themselves the trouble of thinking, be inclined to confound the usefulness of a rule with the certainty of a truth, and accept the one for the other; especially if they are men accustomed rather to compute than to think; earnest rather to go on fast and far, than solicitous to set out warily and see their way distinctly.

11. The points or mere limits of nascent lines are undoubtedly equal, as having no more magnitude one than another, a limit as such being no quantity. If by a momentum you mean more than the very initial limit, it must be either a finite quantity or an infinitesimal. But all finite quantities are expressly excluded from the notion of a momentum. Therefore the momentum must be an infinitesimal. And, indeed, though much artifice hath been employed to escape or avoid the admission of quantities infinitely small, yet it seems ineffectual. For aught I see, you can admit no quantity as a medium between a finite quantity and nothing, without admitting infinitesimals. An increment generated in a finite particle of time is itself a finite particle; and cannot therefore be a momentum. You must therefore take an infinitesimal part of time wherein to generate your momentum. It is said, the magnitude of moments is not considered; and yet these same moments are supposed to be divided into parts. This is not easy to conceive, no more than it is why we should take quantities less than A and B in order to obtain the increment of AB, of which proceeding it must be owned the final cause or motive is obvious; but it is not so obvious or easy to explain a just and legitimate reason for it, or shew it to be geometrical.

12. From the foregoing principle, so demonstrated, the general rule for finding the fluxion of any power of a flowing quantity is derived[1]. But, as there seems to have been some inward scruple or consciousness of defect in the foregoing demonstration, and as this finding the fluxion of a given power is a point of primary importance, it hath therefore been judged proper to demonstrate the same in

[1] [*Philosophiæ Naturalis Principia Mathemati.a*, Lib. II. lem. 2.]—AUTHOR.

a different manner, independent of the foregoing demonstration. But whether this other method be more legitimate and conclusive than the former, I proceed now to examine; and in order thereto shall premise the following lemma:—'If, with a view to demonstrate any proposition, a certain point is supposed, by virtue of which certain other points are attained; and such supposed point be itself afterwards destroyed or rejected by a contrary supposition; in that case, all the other points attained thereby, and consequent thereupon, must also be destroyed and rejected, so as from thenceforward to be no more supposed or applied in the demonstration.' This is so plain as to need no proof.

13. Now, the other method of obtaining a rule to find the fluxion of any power is as follows. Let the quantity x flow uniformly, and be it proposed to find the fluxion of x^n. In the same time that x by flowing becomes $x+o$, the power x^n becomes $\overline{x+o}\,|^n$, i.e. by the method of infinite series

$$x^n + nox^{n-1} + \frac{nn-n}{2}oox^{n-2} + \&c.,$$

and the increments

$$o \text{ and } nox^{n-1} + \frac{nn-n}{2}oox^{n-2} + \&c.$$

are one to another as

$$1 \text{ to } nx^{n-1} + \frac{nn-n}{2}ox^{n-2} + \&c.$$

Let now the increments vanish, and their last proportion will be 1 to nx^{n-1}. But it should seem that this reasoning is not fair or conclusive. For when it is said, let the increments vanish, i.e. let the increments be nothing, or let there be no increments, the former supposition that the increments were something, or that there were increments, is destroyed, and yet a consequence of that supposition, i.e. an expression got by virtue thereof, is retained. Which, by the foregoing lemma, is a false way of reasoning. Certainly when we suppose the increments to vanish, we must suppose their proportions, their expressions, and everything else derived from the supposition of their existence, to vanish with them.

14. To make this point plainer, I shall unfold the reasoning, and propose it in a fuller light to your view. It amounts therefore to this, or may in other words be thus expressed. I suppose that the quantity x flows, and by flowing is increased, and its increment I call o, so that by flowing it becomes $x+o$. And as x increaseth, it follows that every power of x is likewise increased in a due proportion. Therefore as x becomes $x+o$, x^n will become $\overline{x+o}|^n$: that is, according to the method of infinite series,

$$x^n + nox^{n-1} + \frac{nn-n}{2}oox^{n-2} + \&c.$$

And if from the two augmented quantities we subduct the root and the power respectively, we shall have remaining the two increments, to wit,

$$o \text{ and } nox^{n-1} + \frac{nn-n}{2}oox^{n-2} + \&c.$$

which increments, being both divided by the common divisor o, yield the quotients

$$1 \text{ and } nx^{n-1} + \frac{nn-n}{2}ox^{n-2} + \&c.,$$

which are therefore exponents of the ratio of the increments. Hitherto I have supposed that x flows, that x hath a real increment, that o is something. And I have proceeded all along on that supposition, without which I should not have been able to have made so much as one single step. From that supposition it is that I get at the increment of x^n, that I am able to compare it with the increment of x, and that I find the proportion between the two increments. I now beg leave to make a new supposition contrary to the first, i. e. I will suppose that there is no increment of x, or that o is nothing; which second supposition destroys my first, and is inconsistent with it, and therefore with everything that supposeth it. I do nevertheless beg leave to retain nx^{n-1}, which is an expression obtained in virtue of my first supposition, which necessarily presupposed such supposition, and which could not be obtained without it. All which seems a most inconsistent

way of arguing, and such as would not be allowed of in Divinity.

15. Nothing is plainer than that no just conclusion can be directly drawn from two inconsistent suppositions. You may indeed suppose anything possible; but afterwards you may not suppose anything that destroys what you first supposed: or, if you do, you must begin *de novo*. If therefore you suppose that the augments vanish, i. e. that there are no augments, you are to begin again and see what follows from such supposition. But nothing will follow to your purpose. You cannot by that means ever arrive at your conclusion, or succeed in what is called by the celebrated author, the investigation of the first or last proportions of nascent and evanescent quantities, by instituting the analysis in finite ones. I repeat it again: you are at liberty to make any possible supposition: and you may destroy one supposition by another: but then you may not retain the consequences, or any part of the consequences, of your first supposition so destroyed. I admit that signs may be made to denote either anything or nothing: and consequently that in the original notation $x+o$, o might have signified either an increment or nothing. But then, which of these soever you make it signify, you must argue consistently with such its signification, and not proceed upon a double meaning: which to do were a manifest sophism. Whether you argue in symbols or in words the rules of right reason are still the same. Nor can it be supposed you will plead a privilege in mathematics to be exempt from them.

16. If you assume at first a quantity increased by nothing, and in the expression $x+o$, o stands for nothing, upon this supposition, as there is no increment of the root, so there will be no increment of the power; and consequently there will be none except the first of all those members of the series constituting the power of the binomial; you will therefore never come at your expression of a fluxion legitimately by such method. Hence you are driven into the fallacious way of proceeding to a certain point on the supposition of an increment, and then at once shifting your supposition to that of no increment. There may seem great skill in doing this at a certain point or period. Since, if this second supposition

had been made before the common division by o, all had vanished at once, and you must have got nothing by your supposition. Whereas, by this artifice of first dividing and then changing your supposition, you retain 1 and $nx^{n}-^{1}$. But, notwithstanding all this address to cover it, the fallacy is still the same. For, whether it be done sooner or later, when once the second supposition or assumption is made, in the same instant the former assumption and all that you got by it is destroyed, and goes out together. And this is universally true, be the subject what it will, throughout all the branches of human knowledge; in any other of which, I believe, men would hardly admit such a reasoning as this, which in mathematics is accepted for demonstration.

17. It may not be amiss to observe that the method for finding the fluxion of a rectangle of two flowing quantities, as it is set forth in the Treatise of Quadratures, differs from the above-mentioned taken from the second book of the Principles, and is in effect the same with that used in the *calculus differentialis*[1]. For the supposing a quantity infinitely diminished, and therefore rejecting it, is in effect the rejecting an infinitesimal; and indeed it requires a marvellous sharpness of discernment to be able to distinguish between evanescent increments and infinitesimal differences. It may perhaps be said that the quantity being infinitely diminished becomes nothing, and so nothing is rejected. But, according to the received principles, it is evident that no geometrical quantity can by any division or subdivision whatsoever be exhausted, or reduced to nothing. Considering the various arts and devices used by the great author of the fluxionary method; in how many lights he placeth his fluxions; and in what different ways he attempts to demonstrate the same point; one would be inclined to think, he was himself suspicious of the justness of his own demonstrations, and that he was not enough pleased with any notion steadily to adhere to it. Thus much at least is plain, that he owned himself satisfied concerning certain points which nevertheless he would not undertake to demonstrate to others[2]. Whether

[1] [*Analyse des Infiniment Petits*, Part I. prop. 2.]—AUTHOR. The Newton of the *Quadratura* (1704) differs from the Newton of the *Principia* (1687).

[2] [See *Letter* to Collins, Nov. 8,

this satisfaction arose from tentative methods or inductions, which have often been admitted by mathematicians (for instance, by Dr. Wallis, in his Arithmetic of Infinites), is what I shall not pretend to determine. But, whatever the case might have been with respect to the author, it appears that his followers have shewn themselves more eager in applying his method, than accurate in examining his principles.

18. It is curious to observe what subtlety and skill this great genius employs to struggle with an insuperable difficulty; and through what labyrinths he endeavours to escape the doctrine of infinitesimals; which as it intrudes upon him whether he will or no, so it is admitted and embraced by others without the least repugnance;—Leibnitz and his followers in their *calculus differentialis* making no manner of scruple, first to suppose, and secondly to reject, quantities infinitely small; with what clearness in the apprehension and justness in the reasoning, any thinking man, who is not prejudiced in favour of those things, may easily discern. The notion or idea of an *infinitesimal quantity*, as it is an object simply apprehended by the mind, hath been already considered[1]. I shall now only observe as to the method of getting rid of such quantities, that it is done without the least ceremony. As in fluxions the point of first importance, and which paves the way to the rest, is to find the fluxion of a product of two indeterminate quantities, so in the *calculus differentialis* (which method is supposed to have been borrowed from the former with some small alterations) the main point is to obtain the difference of such product. Now the rule for this is got by rejecting the product or rectangle of the differences. And in general it is supposed that no quantity is bigger or lesser for the addition or subduction of its infinitesimal: and that consequently no error can arise from such rejection of infinitesimals.

19. And yet it should seem that, whatever errors are admitted in the premises, proportional errors ought to be apprehended in the conclusion, be they finite or infinitesimal: and that therefore the ἀκρίβεια of geometry requires nothing should be neglected or rejected. In answer to

1676.]—AUTHOR. John Collins, the mathematician, born 1624, died 1683.

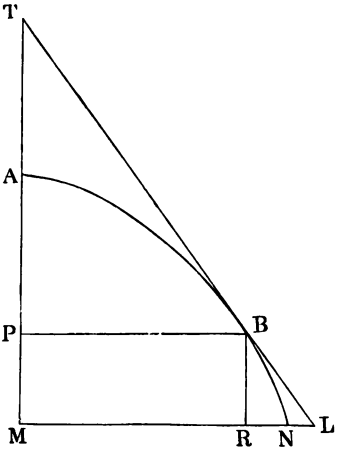
[1] [Sect. 5 and 6.]—AUTHOR.

this you will perhaps say, that the conclusions are accurately true, and that therefore the principles and methods from whence they are derived must be so too. But this inverted way of demonstrating your principles by your conclusions, as it would be peculiar to you gentlemen, so it is contrary to the rules of logic. The truth of the conclusion will not prove either the form or the matter of a syllogism to be true; inasmuch as the illation might have been wrong or the premises false, and the conclusion nevertheless true, though not in virtue of such illation or of such premises. I say that in every other science men prove their conclusions by their principles, and not their principles by the conclusions. But if in yours you should allow yourselves this unnatural way of proceeding, the consequence would be that you must take up with Induction, and bid adieu to Demonstration. And if you submit to this, your authority will no longer lead the way in points of Reason and Science.

20. I have no controversy about your conclusions, but only about your logic and method: how you demonstrate? what objects you are conversant with, and whether you conceive them clearly? what principles you proceed upon; how sound they may be; and how you apply them? It must be remembered that I am not concerned about the truth of your theorems, but only about the way of coming at them; whether it be legitimate or illegitimate, clear or obscure, scientific or tentative. To prevent all possibility of your mistaking me, I beg leave to repeat and insist, that I consider the geometrical analyst as a logician, i.e. so far forth as he reasons and argues; and his mathematical conclusions, not in themselves, but in their premises; not as true or false, useful or insignificant, but as derived from such principles, and by such inferences. And, forasmuch as it may perhaps seem an unaccountable paradox that mathematicians should deduce true propositions from false principles, be right in the conclusion and yet err in the premises; I shall endeavour particularly to explain why this may come to pass, and shew how error may bring forth truth, though it cannot bring forth science.

21. In order therefore to clear up this point, we will suppose for instance that a tangent is to be drawn to

a parabola, and examine the progress of this affair as it is performed by infinitesimal differences. Let AB be a curve, the abscisse $AP=x$, the ordinate $PB=y$, the difference of the abscisse $PM=dx$, the difference of the ordinate $RN=dy$. Now, by supposing the curve to be a polygon, and consequently BN, the increment or difference of the curve, to be a straight line coincident with the tangent, and the differential triangle BRN to be similar to the triangle TPB, the subtangent PT is found a fourth proportional to $RN : RB : PB$: that is, to $dy : dx : y$. Hence the subtangent will be $\frac{y\,dx}{dy}$. But herein



there is an error arising from the forementioned false supposition, whence the value of PT comes out greater than the truth: for in reality it is not the triangle RNB but RLB which is similar to PBT, and therefore (instead of RN) RL should have been the first term of the proportion, i.e. $RN+NL$, i.e. $dy+z$: whence the true expression for the subtangent should have been $\frac{y\,dx}{dy+z}$. There was therefore an error of defect in making dy the divisor; which error was equal to z, i.e. NL the line comprehended between the curve and the tangent. Now by the nature of the curve $yy=px$, supposing p to be the parameter, whence by the rule of differences $2y\,dy=p\,dx$ and $dy=\frac{p\,dx}{2y}$. But if you multiply $y+dy$ by itself, and retain the whole product without rejecting the square of the difference, it will then come out, by substituting the augmented quantities in the equation of the curve, that $dy=\frac{p\,dx}{2y}-\frac{dy\,dy}{2y}$

truly. There was therefore an error of excess in making $dy = \frac{p\,dx}{2y}$, which followed from the erroneous rule of differences. And the measure of this second error is $\frac{dy\,dy}{2y} = z$. Therefore the two errors being equal and contrary destroy each other; the first error of defect being corrected by a second error of excess.

22. If you had committed only one error, you would not have come at a true solution of the problem. But by virtue of a twofold mistake you arrive, though not at science, yet at truth. For science it cannot be called, when you proceed blindfold, and arrive at the truth not knowing how or by what means. To demonstrate that z is equal to $\frac{dy\,dy}{2y}$, let BR or dx be m, and RN or dy be n. By the thirty-third proposition of the first book of the Conics of Apollonius, and from similar triangles, as $2x$ to y so is m to $n+z = \frac{my}{2x}$. Likewise from the nature of the parabola $yy+2yn+nn = xp+mp$, and $2yn+nn = mp$: wherefore $\frac{2yn+nn}{p} = m$: and because $yy = px$, $\frac{yy}{p}$ will be equal to x. Therefore substituting these values instead of m and x we shall have

$$n+z = \frac{my}{2x} = \frac{2yynp+ynnp}{2yyp}:$$

i.e. $$n+z = \frac{2yn+nn}{2y}:$$

which being reduced gives

$$z = \frac{nn}{2y} = \frac{dy\,dy}{2y}\ Q.E.D.$$

23. Now, I observe, in the first place, that the conclusion comes out right, not because the rejected square of dy was infinitely small, but because this error was compensated by another contrary and equal error. I observe, in the second place, that whatever is rejected, be it ever

so small, if it be real, and consequently makes a real error in the premises, it will produce a proportional real error in the conclusion. Your theorems therefore cannot be accurately true, nor your problems accurately solved, in virtue of premises which themselves are not accurate; it being a rule in logic that *conclusio sequitur partem debiliorem.* Therefore, I observe, in the third place, that when the conclusion is evident and the premises obscure, or the conclusion accurate and the premises inaccurate, we may safely pronounce that such conclusion is neither evident nor accurate, in virtue of those obscure inaccurate premises or principles; but in virtue of some other principles, which perhaps the demonstrator himself never knew or thought of. I observe, in the last place, that in case the differences are supposed finite quantities ever so great, the conclusion will nevertheless come out the same: inasmuch as the rejected quantities are legitimately thrown out, not for their smallness, but for another reason, to wit, because of contrary errors, which, destroying each other, do, upon the whole, cause that nothing is really, though something is apparently, thrown out. And this reason holds equally with respect to quantities finite as well as infinitesimal, great as well as small, a foot or a yard long as well as the minutest increment.

24. For the fuller illustration of this point, I shall consider it in another light, and proceeding in finite quantities to the conclusion, I shall only then make use of one infinitesimal. Suppose the straight line MQ cuts the curve AT in the points R and S. Suppose LR a tangent at the point R, AN the abscisse, NR and OS ordinates. Let AN be produced to O, and RP be drawn parallel to NO. Suppose $AN = x$, $NR = y$, $NO = v$, $PS = z$, the subsecant $MN = s$. Let the equation $y = xx$ express the nature of the curve: and supposing y and x increased by their finite increments we get

$$y + z = xx + 2xv + vv :$$

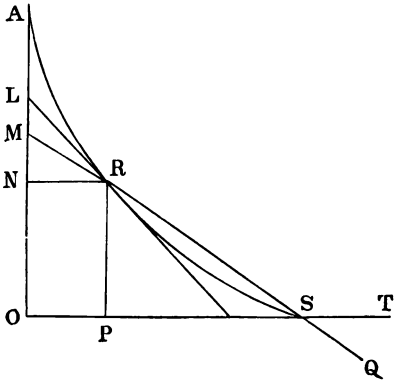
whence the former equation being subducted, there remains $z = 2xv + vv$. And by reason of similar triangles

$$PS : PR :: NR : NM, \text{ i.e. } z : v :: y : s = \frac{vy}{z},$$

wherein if for y and z we substitute their values, we get

$$\frac{vxx}{2xv+vv} = s = \frac{xx}{2x+v}.$$

And supposing NO to be infinitely diminished, the subsecant NM will in that case coincide with the subtangent



NL, and v as an infinitesimal may be rejected, whence it follows that

$$s = NL = \frac{xx}{2x} = \frac{x}{2}:$$

which is the true value of the subtangent. And, since this was obtained by one only error, i. e. by once ejecting one only infinitesimal, it should seem, contrary to what hath been said, that an infinitesimal quantity or difference may be neglected or thrown away, and the conclusion nevertheless be accurately true, although there was no double mistake or rectifying of one error by another, as in the first case. But, if this point be thoroughly considered, we shall find there is even here a double mistake, and that one compensates or rectifies the other. For, in the first place, it was supposed that when NO is infinitely diminished or becomes an infinitesimal then the subsecant NM becomes equal to the subtangent NL. But this is

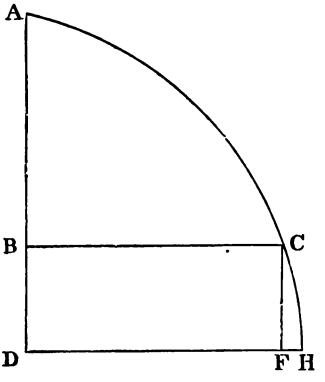
a plain mistake; for it is evident that as a secant cannot be a tangent, so a subsecant cannot be a subtangent. Be the difference ever so small, yet still there is a difference. And, if *NO* be infinitely small, there will even then be an infinitely small difference between *NM* and *NL*. Therefore *NM* or *S* was too little for your supposition (when you supposed it equal to *NL*); and this error was compensated by a second error in throwing out *v*, which last error made *s* bigger than its true value, and in lieu thereof gave the value of the subtangent. This is the true state of the case, however it may be disguised. And to this in reality it amounts, and is at bottom the same thing, if we should pretend to find the subtangent by having first found, from the equation of the curve and similar triangles, a general expression for all subsecants, and then reducing the subtangent under this general rule, by considering it as the subsecant when *v* vanishes or becomes nothing.

25. Upon the whole I observe, First, that *v* can never be nothing, so long as there is a secant. Secondly, that the same line cannot be both tangent and secant. Thirdly, that when *v* or *NO*[1] vanisheth, *PS* and *SR* do also vanish, and with them the proportionality of the similar triangles. Consequently the whole expression, which was obtained by means thereof and grounded thereupon, vanisheth when *v* vanisheth. Fourthly, that the method for finding secants or the expression of secants, be it ever so general, cannot in common sense extend any farther than to all secants whatsoever: and, as it necessarily supposed similar triangles, it cannot be supposed to take place where there are not similar triangles. Fifthly, that the subsecant will always be less than the subtangent, and can never coincide with it; which coincidence to suppose would be absurd; for it would be supposing the same line at the same time to cut and not to cut another given line; which is a manifest contradiction, such as subverts the hypothesis and gives a demonstration of its falsehood. Sixthly, if this be not admitted, I demand a reason why any other apagogical demonstration, or demonstration *ad absurdum* should be admitted in geometry rather than this: or that some real difference be assigned between this and others as such.

[1] [See the foregoing figure.]—AUTHOR.

Seventhly, I observe that it is sophistical to suppose *NO* or *RP*, *PS*, and *SR* to be finite real lines in order to form the triangle, *RPS*, in order to obtain proportions by similar triangles; and afterwards to suppose there are no such lines, nor consequently similar triangles, and nevertheless to retain the consequence of the first supposition, after such supposition hath been destroyed by a contrary one. Eighthly, that although, in the present case, by inconsistent suppositions truth may be obtained, yet such truth is not demonstrated: that such method is not conformable to the rules of logic and right reason: that, however useful it may be, it must be considered only as a presumption, as a knack, an art, rather an artifice, but not a scientific demonstration.

26. The doctrine premised may be farther illustrated by the following simple and easy case, wherein I shall proceed by evanescent increments. Suppose $AB=x$, $BC=y$, $BD=o$, and that xx is equal to the area ABC: it is proposed to find the ordinate y or BC. When x by flowing becomes $x+o$, then xx becomes $xx+2xo+oo$: and the area ABC becomes ADH, and the increment of xx will be equal to $BDHC$, the increment of the area, i. e. to $BCFD+CFH$. And if we suppose the curvilinear space CFH to be qoo, then



$$2xo+oo=yo+qoo,$$

which divided by o gives $2xo=y+qo$. And, supposing o to vanish, $2x=y$, in which case ACH will be a straight line, and the areas ABC, CFH triangles.—Now with regard to this reasoning, it hath been already remarked[1], that it is not legitimate or logical to suppose o to vanish, i. e. to be nothing, i. e. that there is no increment, unless we reject at the same time with the increment itself every consequence of such incre-

[1] [Sect. 12 and 13 *supra*.]—AUTHOR.

ment, i. e. whatsoever could not be obtained by supposing such increment. It must nevertheless be acknowledged that the problem is rightly solved, and the conclusion true, to which we are led by this method. It will therefore be asked, how comes it to pass that the throwing out o is attended with no error in the conclusion? I answer, the true reason hereof is plainly this: because q being unit, qo is equal to o: and therefore

$$2x+o-qo=y=2x,$$

the equal quantities qo and o being destroyed by contrary signs.

27. As, on the one hand, it were absurd to get rid of o by saying, Let me contradict myself; let me subvert my own hypothesis; let me take it for granted that there is no increment, at the same time that I retain a quantity which I could never have got at but by assuming an increment: so, on the other hand, it would be equally wrong to imagine that in a geometrical demonstration we may be allowed to admit any error, though ever so small, or that it is possible, in the nature of things, an accurate conclusion should be derived from inaccurate principles. Therefore o cannot be thrown out as an infinitesimal, or upon the principle that infinitesimals may be safely neglected; but only because it is destroyed by an equal quantity with a negative sign, whence $o-po$ is equal to nothing. And as it is illegitimate to reduce an equation, by subducting from one side a quantity when it is not to be destroyed, or when an equal quantity is not subducted from the other side of the equation: so it must be allowed a very logical and just method of arguing to conclude that if from equals either nothing or equal quantities are subducted they shall still remain equal. And this is a true reason why no error is at last produced by the rejecting of o. Which therefore must not be ascribed to the doctrine of differences, or infinitesimals, or evanescent quantities, or momentums, or fluxions.

28. Suppose the case to be general, and that x^n is equal to the area ABC, whence by the method of fluxions the ordinate is found nx^{n-1}, which we admit for true, and shall inquire how it is arrived at. Now if we are content to come at the conclusion in a summary way, by supposing

that the ratio of the fluxions of x and x^n is found[1] to be 1 and nx^{n-1}, and that the ordinate of the area is considered as its fluxion, we shall not so clearly see our way, or perceive how the truth comes out—that method as we have shewed before being obscure and illogical. But if we fairly delineate the area and its increment, and divide the latter into two parts $BCFD$ and CFH[2], and proceed regularly by equations between the algebraical and geometrical quantities, the reason of the thing will plainly appear. For, as x^n is equal to the area ABC, so is the increment of x^n equal to the increment of the area, i. e. to $BDHC$; that is to say

$$nox^{n-1} + \frac{nn-n}{2} oox^{n-2} + \&c. = BDFC + CFH.$$

And only the first members on each side of the equation being retained, $nox^{n-1} = BDFC$: and dividing both sides by o or BD, we shall get $nx^{n-1} = BC$. Admitting therefore that the curvilinear space CFH is equal to the rejectaneous quantity

$$\frac{nn-n}{2} oox^{n-2} + \&c.,$$

and that when this is rejected on one side, that is rejected on the other, the reasoning becomes just and the conclusion true. And it is all one whatever magnitude you allow to BD, whether that of an infinitesimal difference or a finite increment ever so great. It is therefore plain that the supposing the rejectaneous algebraical quantity to be an infinitely small or evanescent quantity, and therefore to be neglected, must have produced an error, had it not been for the curvilinear spaces being equal thereto, and at the same time subducted from the other part or side of the equation, agreeably to the axiom, *If from equals you subduct equals, the remainders will be equal.* For those quantities which by the analysts are said to be neglected, or made to vanish, are in reality subducted. If therefore the conclusion be true, it is absolutely necessary that the finite

[1] [Sect. 13.]—AUTHOR.
[2] [See the figure in sect. 26.]—AUTHOR.

space *CFH* be equal to the remainder of the increment expressed by

$$\frac{nn-n}{2}oox^{n-2}\ \&c.;$$

equal, I say, to the finite remainder of a finite increment.

29. Therefore, be the power what you please, there will arise on one side an algebraical expression, on the other a geometrical quantity, each of which naturally divides itself into three members. The algebraical or fluxionary expression, into one which includes neither the expression of the increment of the absciss nor of any power thereof; another which includes the expression of the increment itself; and the third including the expression of the powers of the increment. The geometrical quantity also or whole increased area consists of three parts or members—the first of which is the given area; the second a rectangle under the ordinate and the increment of the absciss; and the third a curvilinear space. And, comparing the homologous or correspondent members on both sides, we find that as the first member of the expression is the expression of the given area, so the second member of the expression will express the rectangle or second member of the geometrical quantity, and the third, containing the powers of the increment, will express the curvilinear space, or third member of the geometrical quantity. This hint may perhaps be further extended, and applied to good purpose, by those who have leisure and curiosity for such matters. The use I make of it is to shew, that the analysis cannot obtain in augments or differences, but it must also obtain in finite quantities, be they ever so great, as was before observed.

30. It seems therefore, upon the whole, that we may safely pronounce the conclusion cannot be right, if in order thereto any quantity be made to vanish, or be neglected—except that either one error is redressed by another; or that, secondly, on the same side of an equation equal quantities are destroyed by contrary signs, so that the quantity we mean to reject is first annihilated; or, lastly, that from the opposite sides equal quantities are subducted. And therefore to get rid of quantities by the received principles of fluxions or of differences is neither good

geometry nor good logic. When the augments vanish, the velocities also vanish. The velocities or fluxions are said to be *primo* and *ultimo*, as the augments nascent and evanescent. Take therefore the *ratio* of the evanescent quantities, it is the same with that of the fluxions. It will therefore answer all intents as well. Why then are fluxions introduced? Is it not to shun or rather to palliate the use of quantities infinitely small? But we have no notion whereby to conceive and measure various degrees of velocity besides space and time; or, when the times are given, besides space alone. We have even no notion of velocity prescinded from time and space. When therefore a point is supposed to move in given times, we have no notion of greater or lesser velocities, or of proportions between velocities, but only of longer or shorter lines, and of proportions between such lines generated in equal parts of time.

31. A point may be the limit of a line: a line may be the limit of a surface: a moment may terminate time. But how can we conceive a velocity by the help of such limits? It necessarily implies both time and space, and cannot be conceived without them. And if the velocities of nascent and evanescent quantities, i. e. abstracted from time and space, may not be comprehended, how can we comprehend and demonstrate their proportions; or consider their *rationes primæ* and *ultimæ*? For, to consider the proportion or *ratio* of things implies that such things have magnitude; that such their magnitudes may be measured, and their relations to each other known. But, as there is no measure of velocity except time and space, the proportion of velocities being only compounded of the direct proportion of the spaces, and the reciprocal proportion of the times; doth it not follow that to talk of investigating, obtaining, and considering the proportions of velocities, exclusively of time and space, is to talk unintelligibly?

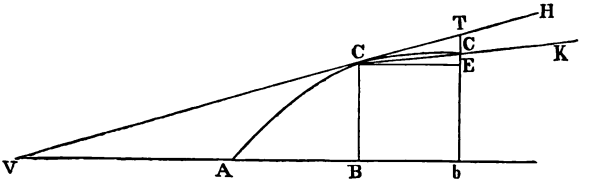
32. But you will say that, in the use and application of fluxions, men do not overstrain their faculties to a precise conception of the above-mentioned velocities, increments, infinitesimals, or any other such-like ideas of a nature so nice, subtle, and evanescent. And therefore you will perhaps maintain that problems may be solved without those inconceivable suppositions; and that, consequently,

the doctrine of fluxions, as to the practical part, stands clear of all such difficulties. I answer that if in the use or application of this method those difficult and obscure points are not attended to, they are nevertheless supposed. They are the foundations on which the moderns build the principles on which they proceed, in solving problems and discovering theorems. It is with the method of fluxions as with all other methods, which presuppose their respective principles and are grounded thereon; although the rules may be practised by men who neither attend to, nor perhaps know the principles. In like manner, therefore, as a sailor may practically apply certain rules derived from astronomy and geometry, the principles whereof he doth not understand; and as any ordinary man may solve divers numerical questions, by the vulgar rules and operations of arithmetic, which he performs and applies without knowing the reasons of them: even so it cannot be denied that you may apply the rules of the fluxionary method: you may compare and reduce particular cases to general forms: you may operate and compute and solve problems thereby, not only without an actual attention to, or an actual knowledge of, the grounds of that method, and the principles whereon it depends, and whence it is deduced, but even without having ever considered or comprehended them.

33. But then it must be remembered that in such case, although you may pass for an artist, computist, or analyst, yet you may not be justly esteemed a man of science and demonstration. Nor should any man, in virtue of being conversant in such obscure analytics, imagine his rational faculties to be more improved than those of other men which have been exercised in a different manner and on different subjects; much less erect himself into a judge and an oracle concerning matters that have no sort of connexion with or dependence on those species, symbols, or signs, in the management whereof he is so conversant and expert. As you, who are a skilful computist or analyst, may not therefore be deemed skilful in anatomy; or *vice versa*, as a man who can dissect with art may, nevertheless, be ignorant in your art of computing: even so you may both, notwithstanding your peculiar skill in your respective arts, be alike unqualified to decide upon

logic, or metaphysics, or ethics, or religion. And this would be true, even admitting that you understood your own principles and could demonstrate them.

34. If it is said that fluxions may be expounded or expressed by finite lines proportional to them; which finite lines, as they may be distinctly conceived and known and reasoned upon, so they may be substituted for the fluxions, and their mutual relations or proportions be considered as the proportions of fluxions—by which means the doctrine becomes clear and useful: I answer that if, in order to arrive at these finite lines proportional to the fluxions, there be certain steps made use of which are obscure and inconceivable, be those finite lines themselves ever so clearly conceived, it must nevertheless be acknowledged that your proceeding is not clear nor your method scientific. For instance, it is supposed that *AB* being the



absciss, *BC* the ordinate, and *VCH* a tangent of the curve *AC*, *Bb* or *CE* the increment of the absciss, *Ec* the increment of the ordinate, which produced meets *VH* in the point *T* and *Cc* the increment of the curve. The right line *Cc* being produced to *K*, there are formed three small triangles, the rectilinear *CEc*, the mixtilinear *CEc*, and the rectilinear triangle *CET*. It is evident these three triangles are different from each other, the rectilinear *CEc* being less than the mixtilinear *CEc*, whose sides are the three increments above mentioned, and this still less than the triangle *CET*. It is supposed that the ordinate *bc* moves into the place *BC*, so that the point *c* is coincident with the point *C*; and the right line *CK*, and consequently the curve *Cc*, is coincident with the tangent *CH*. In which case the mixtilinear evanescent triangle *CEc* will, in its last form, be similar to the triangle *CET*: and its evanes-

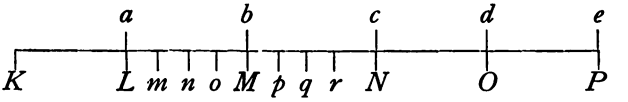
cent sides CE, Ec, and Cc, will be proportional to CE, ET, and CT, the sides of the triangle CET. And therefore it is concluded that the fluxions of the lines AB, BC, and AC, being in the last ratio of their evanescent increments, are proportional to the sides of the triangle CET, or, which is all one, of the triangle VBC similar thereunto[1]. It is particularly remarked and insisted on by the great author, that the points C and c must not be distant one from another, by any the least interval whatsoever: but that, in order to find the ultimate proportions of the lines CE, Ec, and Cc (i.e. the proportions of the fluxions or velocities) expressed by the finite sides of the triangle VBC, the points C and c must be accurately coincident, i.e. one and the same. A point therefore is considered as a triangle, or a triangle is supposed to be formed in a point. Which to conceive seems quite impossible. Yet some there are who, though they shrink at all other mysteries, make no difficulty of their own, who strain at a gnat and swallow a camel.

35. I know not whether it be worth while to observe, that possibly some men may hope to operate by symbols and suppositions, in such sort as to avoid the use of fluxions, momentums, and infinitesimals, after the following manner. Suppose x to be an abscis of a curve, and z another abscis of the same curve. Suppose also that the respective areas are xxx and zzz: and that $z-x$ is the increment of the abscis, and $zzz-xxx$ the increment of the area, without considering how great or how small those increments may be. Divide now $zzz-xxx$ by $z-x$, and the quotient will be $zz+zx+xx$: and, supposing that z and x are equal, the same quotient will be $3xx$, which in that case is the ordinate, which therefore may be thus obtained independently of fluxions and infinitesimals. But herein is a direct fallacy: for, in the first place, it is supposed that the abscisses z and x are unequal, without which supposition no one step could have been made; and in the second place, it is supposed they are equal; which is a manifest inconsistency, and amounts to the same thing that hath been before considered[2]. And there is indeed reason to apprehend that all attempts for setting the

[1] [*Introd. ad Quadraturam Curvarum.*]—AUTHOR.
[2] [Sect. 15.]—AUTHOR.

abstruse and fine geometry on a right foundation, and avoiding the doctrine of velocities, momentums, &c., will be found impracticable, till such time as the object and end of geometry are better understood than hitherto they seem to have been. The great author of the method of fluxions felt this difficulty, and therefore he gave in to those nice abstractions and geometrical metaphysics without which he saw nothing could be done on the received principles: and what in the way of demonstration he hath done with them the reader will judge. It must, indeed, be acknowledged that he used fluxions, like the scaffold of a building, as things to be laid aside or got rid of as soon as finite lines were found proportional to them. But then these finite exponents are found by the help of fluxions. Whatever therefore is got by such exponents and proportions is to be ascribed to fluxions: which must therefore be previously understood. And what are these fluxions? The velocities of evanescent increments. And what are these same evanescent increments? They are neither finite quantities, nor quantities infinitely small, nor yet nothing. May we not call them the ghosts of departed quantities?

36. Men too often impose on themselves and others as if they conceived and understood things expressed by signs, when in truth they have no idea, save only of the very signs themselves. And there are some grounds to apprehend that this may be the present case. The velocities of evanescent or nascent quantities are supposed to be expressed, both by finite lines of a determinate magnitude, and by algebraical notes or signs: but I suspect that many who, perhaps never having examined the matter take it for granted, would, upon a narrow scrutiny, find it impossible to frame any idea or notion whatsoever of those velocities, exclusive of such finite quantities and signs.



Suppose the line *KP* described by the motion of a point continually accelerated, and that in equal particles of time the unequal parts *KL*, *LM*, *MN*, *NO*, &c. are generated.

Suppose also that *a, b, c, d, e,* &c. denote the velocities of the generating point, at the several periods of the parts or increments so generated. It is easy to observe that these increments are each proportional to the sum of the velocities with which it is described: that, consequently, the several sums of the velocities, generated in equal parts of time, may be set forth by the respective lines *KL, LM, MN,* &c. generated in the same times. It is likewise an easy matter to say, that the last velocity generated in the first particle of time may be expressed by the symbol *a,* the last in the second by *b,* the last generated in the third by *c,* and so on: that *a* is the velocity of *LM* in *statu nascenti,* and *b, c, d, e,* &c. are the velocities of the increments *MN, NO, OP,* &c. in their respective nascent estates. You may proceed and consider these velocities themselves as flowing or increasing quantities, taking the velocities of the velocities, and the velocities of the velocities of the velocities, i.e. the first, second, third, &c. velocities *ad infinitum*: which succeeding series of velocities may be thus expressed,

$$a.\ b-a.\ c-2b+a.\ d-3c-3b-a \text{ \&c.},$$

which you may call by the names of first, second, third, fourth fluxions. And for an apter expression you may denote the variable flowing line *KL, KM, KN,* &c. by the letter x; and the first fluxions by $\dot{x}$, the second by $\ddot{x}$, the third by $\dddot{x}$, and so on *ad infinitum.*

37. Nothing is easier than to assign names, signs, or expressions to these fluxions; and it is not difficult to compute and operate by means of such signs. But it will be found much more difficult to omit the signs and yet retain in our minds the things which we suppose to be signified by them. To consider the exponents, whether geometrical, or algebraical, or fluxionary, is no difficult matter. But to form a precise idea of a third velocity for instance, in itself and by itself, *Hoc opus, hic labor.* Nor indeed is it an easy point to form a clear and distinct idea of any velocity at all, exclusive of and prescinding from all length of time and space; as also from all notes, signs, or symbols whatsoever. This, if I may be allowed to judge of others by myself, is impossible. To me it seems evident

that measures and signs are absolutely necessary in order to conceive or reason about velocities; and that consequently, when we think to conceive the velocities simply and in themselves, we are deluded by vain abstractions.

38. It may perhaps be thought by some an easier method of conceiving fluxions to suppose them the velocities wherewith the infinitesimal differences are generated. So that the first fluxions shall be the velocities of the first differences, the second the velocities of the second differences, the third fluxions the velocities of the third differences, and so on *ad infinitum*. But, not to mention the insurmountable difficulty of admitting or conceiving infinitesimals, and infinitesimals of infinitesimals, &c., it is evident that this notion of fluxions would not consist with the great author's view; who held that the minutest quantity ought not to be neglected, that therefore the doctrine of infinitesimal differences was not to be admitted in geometry, and who plainly appears to have introduced the use of velocities or fluxions, on purpose to exclude or do without them.

39. To others it may possibly seem that we should form a juster idea of fluxions by assuming the finite, unequal, isochronal increments *KL*, *LM*, *MN*, &c., and considering them in *statu nascenti*, also their increments in *statu nascenti*, and the nascent increments of those increments, and so on, supposing the first nascent increments to be proportional to the first fluxions or velocities, the nascent increments of those increments to be proportional to the second fluxions, the third nascent increments to be proportional to the third fluxions, and so onwards. And, as the first fluxions are the velocities of the first nascent increments, so the second fluxions may be conceived to be the velocities of the second nascent increments, rather than the velocities of velocities. By which means the analogy of fluxions may seem better preserved, and the notion rendered more intelligible.

40. And indeed it should seem that in the way of obtaining the second or third fluxion of an equation the given fluxions were considered rather as increments than velocities. But the considering them sometimes in one sense, sometimes in another, one while in themselves, another in their exponents, seems to have occasioned no

small share of that confusion and obscurity which are found in the doctrine of fluxions. It may seem therefore that the notion might be still mended, and that instead of fluxions of fluxions, or fluxions of fluxions of fluxions, and instead of second, third, or fourth, &c. fluxions of a given quantity, it might be more consistent and less liable to exception to say, the fluxion of the first nascent increment, i.e. the second fluxion; the fluxion of the second nascent increment, i.e. the third fluxion; the fluxion of the third nascent increment, i.e. the fourth fluxion—which fluxions are conceived respectively proportional, each to the nascent principle of the increment succeeding that whereof it is the fluxion.

41. For the more distinct conception of all which it may be considered that if the finite increment LM [1] be divided into the isochronal parts Lm, mn, no, oM; and the increment MN into the parts Mp, pq, qr, rN isochronal to the former; as the whole increments LM, MN are proportional to the sums of their describing velocities, even so the homologous particles Lm, Mp are also proportional to the respective accelerated velocities with which they are described. And, as the velocity with which Mp is generated, exceeds that with which Lm was generated, even so the particle Mp exceeds the particle Lm. And in general, as the isochronal velocities describing the particles of MN exceed the isochronal velocities describing the particles of LM, even so the particles of the former exceed the correspondent particles of the latter. And this will hold, be the said particles ever so small. MN therefore will exceed LM if they are both taken in their nascent states: and that excess will be proportional to the excess of the velocity b above the velocity a. Hence we may see that this last account of fluxions comes, in the upshot, to the same thing with the first [2].

42. But, notwithstanding what hath been said, it must still be acknowledged that the finite particles Lm or Mp, though taken ever so small, are not proportional to the velocities a and b; but each to a series of velocities changing every moment, or which is the same thing, to an accelerated velocity, by which it is generated during

[1] [See the foregoing scheme in sect. 36.]—AUTHOR.

[2] [See the foregoing scheme in sect. 36.]—AUTHOR.

a certain minute particle of time: that the nascent beginnings or evanescent endings of finite quantities, which are produced in moments of infinitely small parts of time, are alone proportional to given velocities: that therefore, in order to conceive the first fluxions, we must conceive time divided into moments, increments generated in those moments, and velocities proportional to those increments: that, in order to conceive second and third fluxions, we must suppose that the nascent principles or momentaneous increments have themselves also other momentaneous increments, which are proportional to their respective generating velocities: that the velocities of these second momentaneous increments are second fluxions: those of their nascent momentaneous increments third fluxions. And so on *ad infinitum.*

43. By subducting the increment generated in the first moment from that generated in the second, we get the increment of an increment. And by subducting the velocity generating in the first moment from that generating in the second, we get a fluxion of a fluxion. In like manner, by subducting the difference of the velocities generating in the two first moments from the excess of the velocity in the third above that in the second moment, we obtain the third fluxion. And after the same analogy we may proceed to fourth, fifth, sixth fluxions, &c. And if we call the velocities of the first, second, third, fourth moments, *a, b, c, d,* the series of fluxions will be as above, $a.\ b-a.\ c-2b+a.\ d-3c+3b-a.$ *ad infinitum,* i.e. $\dot{x}.\ \ddot{x}.\ \dddot{x}.\ \ddddot{x}.\ \dot{\ddddot{x}}.$ *ad infinitum.*

44. Thus fluxions may be considered in sundry lights and shapes, which seem all equally difficult to conceive. And, indeed, as it is impossible to conceive velocity without time or space, without either finite length or finite duration[1], it must seem above the powers of men to comprehend even the first fluxions. And if the first are incomprehensible, what shall we say of the second and third fluxions, &c.? He who can conceive the beginning of a beginning, or the end of an end, somewhat before the first or after the last, may be perhaps sharpsighted enough

[1] [Sect. 31.]—AUTHOR.

to conceive these things. But most men will, I believe, find it impossible to understand them in any sense whatever.

45. One would think that men could not speak too exactly on so nice a subject. And yet, as was before hinted, we may often observe that the exponents of fluxions, or notes representing fluxions are compounded with the fluxions themselves. Is not this the case when, just after the fluxions of flowing quantities were said to be the celerities of their increasing, and the second fluxions to be the mutations of the first fluxions or celerities, we are told that $z.\ z.\ z.\ \dot{z}.\ \ddot{z}.\ \dddot{z}.$[1] represents a series of quantities whereof each subsequent quantity is the fluxion of the preceding; and each foregoing is a fluent quantity having the following one for its fluxion?

46. Divers series of quantities and expressions, geometrical and algebraical, may be easily conceived, in lines, in surfaces, in species, to be continued without end or limit. But it will not be found so easy to conceive a series, either of mere velocities or of mere nascent increments, distinct therefrom and corresponding thereunto. Some perhaps may be led to think the author intended a series of ordinates, wherein each ordinate was the fluxion of the preceding and fluent of the following, i.e. that the fluxion of one ordinate was itself the ordinate of another curve; and the fluxion of this last ordinate was the ordinate of yet another curve; and so on *ad infinitum*. But who can conceive how the fluxion (whether velocity or nascent increment) or an ordinate should be itself an ordinate? Of more than that each preceding quantity or fluent is related to its subsequent or fluxion, as the area of a curvilinear figure to its ordinate; agreeably to what the author remarks, that each preceding quantity in such series is as the area of a curvilinear figure, whereof the absciss is z, and the ordinate is the following quantity?

47. Upon the whole it appears that the celerities are dismissed, and instead thereof areas and ordinates are introduced. But, however expedient such analogies or such expressions may be found for facilitating the modern

[1] [*De Quadratura Curvarum.*]—AUTHOR.

quadratures, yet we shall not find any light given us thereby into the original real nature of fluxions; or that we are enabled to frame from thence just ideas of fluxions considered in themselves. In all this the general ultimate drift of the author is very clear, but his principles are obscure. But perhaps those theories of the great author are not minutely considered or canvassed by his disciples; who seem eager, as was before hinted, rather to operate than to know, rather to apply his rules and his forms than to understand his principles and enter into his notions. It is nevertheless certain that, in order to follow him in his quadratures, they must find fluents from fluxions; and in order to this, they must know to find fluxions from fluents; and in order to find fluxions, they must first know what fluxions are. Otherwise they proceed without clearness and without science. Thus the direct method precedes the inverse, and the knowledge of the principles is supposed in both. But as for operating according to rules, and by the help of general forms, whereof the original principles and reasons are not understood, this is to be esteemed merely technical. Be the principles therefore ever so abstruse and metaphysical, they must be studied by whoever would comprehend the doctrine of fluxions. Nor can any geometrician have a right to apply the rules of the great author, without first considering his metaphysical notions whence they were derived. These, how necessary soever in order to science—which can never be obtained without a precise, clear, and accurate conception of the principles—are nevertheless by several carelessly passed over; while the expressions alone are dwelt on and considered and treated with great skill and management, thence to obtain other expressions by methods suspicious and indirect (to say the least) if considered in themselves, however recommended by Induction and Authority—two motives which are acknowledged sufficient to beget a rational faith and moral persuasion, but nothing higher.

48. You may possibly hope to evade the force of all that hath been said, and to screen false principles and inconsistent reasonings, by a general pretence that these objections and remarks are *metaphysical*. But this is a vain

pretence. For the plain sense and truth of what is advanced in the foregoing remarks, I appeal to the understanding of every unprejudiced intelligent reader. To the same I appeal, whether the points remarked upon are not most incomprehensible metaphysics. And metaphysics not of mine, but your own. I would not be understood to infer that your notions are false or vain because they are metaphysical. Nothing is either true or false for that reason. Whether a point be called metaphysical or no avails little. The question is, whether it be clear or obscure, right or wrong, well or ill deduced?

49. Although momentaneous increments, nascent and evanescent quantities, fluxions and infinitesimals of all degrees, are in truth such shadowy entities, so difficult to imagine or conceive distinctly, that (to say the least) they cannot be admitted as principles or objects of clear and accurate science; and although this obscurity and incomprehensibility of your metaphysics had been alone sufficient to allay your pretensions to evidence; yet it hath, if I mistake not, been farther shewn, that your inferences are no more just than your conceptions are clear, and that your logics are as exceptionable as your metaphysics. It should seem, therefore, upon the whole, that your conclusions are not attained by just reasoning from clear principles: consequently, that the employment of modern analysts, however useful in mathematical calculations and constructions, doth not habituate and qualify the mind to apprehend clearly and infer justly; and, consequently, that you have no right, in virtue of such habits, to dictate out of your proper sphere, beyond which your judgment is to pass for no more than that of other men[1].

50. Of a long time I have suspected that these modern analytics were not scientifical, and gave some hints thereof

[1] The inefficiency of the modern mathematical analysis as an exercise of the spiritual life in man, and accordingly the one-sidedness of the culture which it affords, is a commonplace of educational and philosophical criticism. Exclusive mathematicians reduce the faculties that are concerned with the final problems of concrete reality to a state of atrophy. Berkeley condemns at once the metaphysical inconsistency, and the mathematical inconclusiveness of certain mathematical minute philosophers.

to the public about twenty-five years ago[1]. Since which time, I have been diverted by other occupations, and imagined I might employ myself better than in deducing and laying together my thoughts on so nice a subject. And though of late I have been called upon to make good my suggestions; yet, as the person who made this call doth not appear to think maturely enough to understand either those metaphysics which he would refute, or mathematics which he would patronize, I should have spared myself the trouble of writing for his conviction. Nor should I now have troubled you or myself with this address, after so long an intermission of these studies, were it not to prevent, so far as I am able, your imposing on yourself and others in matters of much higher moment and concern. And, to the end that you may more clearly comprehend the force and design of the foregoing remarks, and pursue them still farther in your own meditations, I shall subjoin the following Queries:—

Query 1. Whether the object of geometry be not the proportions of assignable extensions? And whether there be any need of considering quantities either infinitely great or infinitely small?

Qu. 2. Whether the end of geometry be not to measure assignable finite extension? And whether this practical view did not first put men on the study of geometry?

Qu. 3. Whether the mistaking the object and end of geometry hath not created needless difficulties, and wrong pursuits in that science?

Qu. 4. Whether men may properly be said to proceed in a scientific method, without clearly conceiving the object they are conversant about, the end proposed, and the method by which it is pursued?

Qu. 5. Whether it doth not suffice, that every assignable number of parts may be contained in some assignable magnitude? And whether it be not unnecessary, as well as absurd, to suppose that finite extension is infinitely divisible?

[1] See *Principles of Human Knowledge*, sect. 123—134, with which, as well as with the reasonings, in the same treatise and in the *De Motu*, against *absolute* space, time, and motion, and on elimination of infinity, the following Queries may be compared; also *Essay on Vision*, sect. 121–126; 149–160. Berkeley's earliest publications (in 1707) are mathematical.

Qu. 6. Whether the diagrams in a geometrical demonstration are not to be considered as signs of all possible finite figures, of all sensible and imaginable extensions or magnitudes of the same kind?

Qu. 7. Whether it be possible to free geometry from insuperable difficulties and absurdities, so long as either the abstract general idea of extension, or absolute external extension be supposed its true object?

Qu. 8. Whether the notions of absolute time, absolute place, and absolute motion be not most abstractedly metaphysical? Whether it be possible for us to measure, compute, or know them?

Qu. 9. Whether mathematicians do not engage themselves in disputes and paradoxes concerning what they neither do nor can conceive? And whether the doctrine of forces be not a sufficient proof of this [1]?

Qu. 10. Whether in geometry it may not suffice to consider assignable finite magnitude, without concerning ourselves with infinity? And whether it would not be righter to measure large polygons having finite sides, instead of curves, than to suppose curves are polygons of infinitesimal sides, a supposition neither true nor conceivable?

Qu. 11. Whether many points which are not readily assented to are not nevertheless true? And whether those in the two following queries may not be of that number?

Qu. 12. Whether it be possible that we should have had an idea or notion of extension prior to motion? Or whether, if a man had never perceived motion, he would ever have known or conceived one thing to be distant from another [2]?

Qu. 13. Whether geometrical quantity hath co-existent parts? And whether all quantity be not in a flux as well as time and motion?

Qu. 14. Whether extension can be supposed an attribute of a Being immutable and eternal?

Qu. 15. Whether to decline examining the principles,

[1] [See a Latin treatise *De Motu*, published at London, in the year 1721.]—AUTHOR.

[2] Compare the *Essay on Vision* with these two pregnant Queries, regarding the relation of sense-presented motion to trinal extension.

and unravelling the methods used in mathematics would not shew a bigotry in mathematicians?

Qu. 16. Whether certain maxims do not pass current among analysts which are shocking to good sense? And whether the common assumption, that a finite quantity divided by nothing is infinite, be not of this number?

Qu. 17. Whether the considering geometrical diagrams absolutely or in themselves, rather than as representatives of all assignable magnitudes or figures of the same kind, be not a principal cause of the supposing finite extension infinitely divisible; and of all the difficulties and absurdities consequent thereupon?

Qu. 18. Whether, from geometrical propositions being general, and the lines in diagrams being therefore general substitutes or representatives, it doth not follow that we may not limit or consider the number of parts into which such particular lines are divisible?

Qu. 19. When it is said or implied, that such a certain line delineated on paper contains more than any assignable number of parts, whether any more in truth ought to be understood, than that it is a sign indifferently representing all finite lines, be they ever so great. In which relative capacity it contains, i. e. stands for more than any assignable number of parts? And whether it be not altogether absurd to suppose a finite line, considered in itself or in its own positive nature, should contain an infinite number of parts?

Qu. 20. Whether all arguments for the infinite divisibility of finite extension do not suppose and imply, either general abstract ideas, or absolute external extension to be the object of geometry? And, therefore, whether, along with those suppositions, such arguments also do not cease and vanish?

Qu. 21. Whether the supposed infinite divisibility of finite extension hath not been a snare to mathematicians and a thorn in their sides? And whether a quantity infinitely diminished and a quantity infinitely small are not the same thing?

Qu. 22. Whether it be necessary to consider velocities of nascent or evanescent quantities, or moments, or infinitesimals? And whether the introducing of things so inconceivable be not a reproach to mathematics?

Qu. 23. Whether inconsistencies can be truths? Whether points repugnant and absurd are to be admitted upon any subjects, or in any science? And whether the use of infinites ought to be allowed as a sufficient pretext and apology for the admitting of such points in geometry?

Qu. 24. Whether a quantity be not properly said to be known, when we know its proportion to given quantities? And whether this proportion can be known but by expressions or exponents, either geometrical, algebraical, or arithmetical? And whether expressions in lines or species can be useful but so far forth as they are reducible to numbers?

Qu. 25. Whether the finding out proper expressions or notations of quantity be not the most general character and tendency of the mathematics? And arithmetical operation that which limits and defines their use?

Qu. 26. Whether mathematicians have sufficiently considered the analogy and use of signs? And how far the specific limited nature of things corresponds thereto?

Qu. 27. Whether because, in stating a general case of pure algebra, we are at full liberty to make a character denote either a positive or a negative quantity, or nothing at all, we may therefore, in a geometrical case, limited by hypotheses and reasonings from particular properties and relations of figures, claim the same licence?

Qu. 28. Whether the shifting of the hypothesis, or (as we may call it) the *fallacia suppositionis* be not a sophism that far and wide infects the modern reasonings, both in the mechanical philosophy and in the abstruse and fine geometry?

Qu. 29. Whether we can form an idea or notion of velocity distinct from and exclusive of its measures, as we can of heat distinct from and exclusive of the degrees on the thermometer by which it is measured? And whether this be not supposed in the reasonings of modern analysts?

Qu. 30. Whether motion can be conceived in a point of space? And if motion cannot, whether velocity can? And if not, whether a first or last velocity can be conceived in a mere limit, either initial or final, of the described space?

Qu. 31. Where there are no increments, whether there can be any *ratio* of increments? Whether nothings can be considered as proportional to real quantities? Or whether to talk of their proportions be not to talk nonsense? Also in what sense we are to understand the proportion of a surface to a line, of an area to an ordinate? And whether species or numbers, though properly expressing quantities which are not homogeneous, may yet be said to express their proportion to each other?

Qu. 32. Whether if all assignable circles may be squared, the circle is not, to all intents and purposes, squared as well as the parabola? Or whether a parabolical area can in fact be measured more accurately than a circular?

Qu. 33. Whether it would not be righter to approximate fairly than to endeavour at accuracy by sophisms?

Qu. 34. Whether it would not be more decent to proceed by trials and inductions, than to pretend to demonstrate by false principles?

Qu. 35. Whether there be not a way of arriving at truth, although the principles are not scientific, nor the reasoning just? And whether such a way ought to be called a knack or a science?

Qu. 36. Whether there can be science of the conclusion where there is not science of the principles? And whether a man can have science of the principles without understanding them? And therefore, whether the mathematicians of the present age act like men of science, in taking so much more pains to apply their principles than to understand them?

Qu. 37. Whether the greatest genius wrestling with false principles may not be foiled? And whether accurate quadratures can be obtained without new *postulata* or assumptions? And if not, whether those which are intelligible and consistent ought not to be preferred to the contrary? See sect. 28 and 29.

Qu. 38. Whether tedious calculations in algebra and fluxions be the likeliest method to improve the mind? And whether men's being accustomed to reason altogether about mathematical signs and figures doth not make them at a loss how to reason without them?

Qu. 39. Whether, whatever readiness analysts acquire in stating a problem, or finding apt expressions for mathe-

matical quantities, the same doth necessarily infer a proportionable ability in conceiving and expressing other matters?

Qu. 40. Whether it be not a general case or rule, that one and the same coefficient dividing equal products gives equal quotients? And yet whether such coefficient can be interpreted by o or nothing? Or whether any one will say that if the equation $2 \times o = 5 \times o$, be divided by o, the quotients on both sides are equal? Whether therefore a case may not be general with respect to all quantities and yet not extend to nothings, or include the case of nothing? And whether the bringing nothing under the notion of quantity may not have betrayed men into false reasoning?

Qu. 41. Whether in the most general reasonings about equalities and proportions men may not demonstrate as well as in geometry? Whether in such demonstrations they are not obliged to the same strict reasoning as in geometry? And whether such their reasonings are not deduced from the same axioms with those in geometry? Whether therefore algebra be not as truly a science as geometry?

Qu. 42. Whether men may not reason in species as well as in words? Whether the same rules of logic do not obtain in both cases? And whether we have not a right to expect and demand the same evidence in both?

Qu. 43. Whether an algebraist, fluxionist, geometrician, or demonstrator of any kind can expect indulgence for obscure principles or incorrect reasonings? And whether an algebraical note or species can at the end of a process be interpreted in a sense which could not have been substituted for it at the beginning? Or whether any particular supposition can come under a general case which doth not consist with the reasoning thereof?

Qu. 44. Whether the difference between a mere computer and a man of science be not, that the one computes on principles clearly conceived, and by rules evidently demonstrated, whereas the other doth not?

Qu. 45. Whether, although geometry be a science, and algebra allowed to be a science, and the analytical a most excellent method, in the application, nevertheless, of the analysis to geometry, men may not have admitted false principles and wrong methods of reasoning?

Qu. 46. Whether, although algebraical reasonings are admitted to be ever so just, when confined to signs or species as general representatives of quantity, you may not nevertheless fall into error, if, when you limit them to stand for particular things, you do not limit yourself to reason consistently with the nature of such particular things? And whether such error ought to be imputed to pure algebra?

Qu. 47. Whether the view of modern mathematicians doth not rather seem to be the coming at an expression by artifice, than the coming at science by demonstration?

Qu. 48. Whether there may not be sound metaphysics as well as unsound? Sound as well as unsound logic? And whether the modern analytics may not be brought under one of these denominations, and which?

Qu. 49. Whether there be not really a *philosophia prima*, a certain transcendental science superior to and more extensive than mathematics, which it might behove our modern analysts rather to learn than despise[1]?

Qu. 50. Whether, ever since the recovery of mathematical learning, there have not been perpetual disputes and controversies among the mathematicians? And whether this doth not disparage the evidence of their methods?

Qu. 51. Whether anything but metaphysics and logic can open the eyes of mathematicians and extricate them out of their difficulties?

Qu. 52. Whether, upon the received principles, a quantity can by any division or subdivision, though carried ever so far, be reduced to nothing?

Qu. 53. Whether, if the end of geometry be practice, and this practice be measuring, and we measure only

[1] So Bacon: 'Because the distributions and partitions of knowledge are not like several lines that meet in one angle, and so touch but in a point; but are like branches of a tree that meet in a stem, which hath a dimension and quantity of entireness and continuance, before it come to discontinue and break itself into arms and boughs; therefore it is good, before we enter into the former distribution, to erect and constitute One Universal Science, by the name of *Philosophia Prima*, Primitive or Summary Philosophy, as the main and common way, before we come where the ways part and divide themselves: which Science whether I should report as deficient or no, I stand doubtful.' (*Advancement of Learning*, Book II.)

assignable extensions, it will not follow that unlimited approximations completely answer the intention of geometry?

Qu. 54. Whether the same things which are now done by infinites may not be done by finite quantities? And whether this would not be a great relief to the imaginations and understandings of mathematical men?

Qu. 55. Whether those philomathematical physicians, anatomists, and dealers in the animal economy, who admit the doctrine of fluxions with an implicit faith, can with a good grace insult other men for believing what they do not comprehend[1]?

Qu. 56. Whether the corpuscularian, experimental, and mathematical philosophy, so much cultivated in the last age, hath not too much engrossed men's attention; some part whereof it might have usefully employed?

Qu. 57. Whether, from this and other concurring causes, the minds of speculative men have not been borne downward, to the debasing and stupifying of the higher faculties? And whether we may not hence account for that prevailing narrowness and bigotry among many who pass for men of science, their incapacity for things moral, intellectual, or theological, their proneness to measure all truths by sense and experience of animal life[2]?

Qu. 58. Whether it be really an effect of thinking, that the same men admire the great author[3] for his fluxions, and deride him for his religion?

Qu. 59. If certain philosophical virtuosi of the present age have no religion, whether it can be said to be want of faith?

Qu. 60. Whether it be not a juster way of reasoning, to recommend points of faith from their effects, than to demonstrate mathematical principles by their conclusions?

Qu. 61. Whether it be not less exceptionable to admit points above reason than contrary to reason?

[1] Seeing that at the point of view of human understanding all science, including mathematical, must retire into mystery and so rest at last in faith, the ultimate incomprehensibility of the universe under its religious conception is no more an argument against theism than the ultimate incomprehensibility of its physical evolution in time is a reason for rejecting mechanical science.

[2] Are not the habits thus formed an explanation of dogmatic agnosticism and its narrow faith at the present time? Cf. *Siris*, sect. 331, 332.

[3] Sir Isaac Newton.

Qu. 62. Whether mysteries may not with better right be allowed of in Divine Faith than in Human Science[1]?

Qu. 63. Whether such mathematicians as cry out against mysteries have ever examined their own principles?

Qu. 64. Whether mathematicians, who are so delicate in religious points, are strictly scrupulous in their own science? Whether they do not submit to authority, take things upon trust, and believe points inconceivable? Whether they have not *their* mysteries, and what is more, their repugnances and contradictions?

Qu. 65. Whether it might not become men who are puzzled and perplexed about their own principles, to judge warily, candidly, and modestly concerning other matters?

Qu. 66. Whether the modern analytics do not furnish a strong *argumentum ad hominem* against the philomathematical infidels of these times?

Qu. 67. Whether it follows from the above-mentioned remarks, that accurate and just reasoning is the peculiar character of the present age? And whether the modern growth of infidelity can be ascribed to a distinction so truly valuable[2]?

[1] Yet the mathematicians tacitly proceed upon them in mathematics, while they complain of them in religion. For, does not all human science finally rest on faith in God?

[2] That those who claim to be 'free-thinkers' are really 'minute philosophers,' whose narrow vision is confined to the data of sense, and who fail to recognise the supernatural in the natural, is the undertone alike of *Alciphron* and the *Analyst*.

A DEFENCE

OF

FREE-THINKING IN MATHEMATICS

IN ANSWER TO

A PAMPHLET OF PHILALETHES CANTABRIGIENSIS

ENTITLED

GEOMETRY NO FRIEND TO INFIDELITY

OR A DEFENCE OF SIR ISAAC NEWTON, AND THE BRITISH MATHEMATICIANS

ALSO

AN APPENDIX CONCERNING

MR. WALTON'S VINDICATION OF THE PRINCIPLES

OF FLUXIONS AGAINST THE OBJECTIONS CONTAINED IN THE ANALYST

WHEREIN IT IS ATTEMPTED TO PUT THIS CONTROVERSY IN SUCH A LIGHT AS THAT EVERY READER MAY BE ABLE TO JUDGE THEREOF

BY THE AUTHOR OF

The Minute Philosopher

'*Veritas odium parit.*'—TER. *And.* I. i. 41.

Ἐπεὶ δὲ ὁ Μαθηματικὸς χρῆται τοῖς Κοινοῖς ἰδίως, καὶ τὰς τούτων ἀρχὰς ἂν εἴη θεωρῆσαι τῆς Πρώτης Φιλοσοφίας.—ARIST. *Metaph.* Lib. X. cap. 4.

First published in 1735.

A DEFENCE

OF

FREE-THINKING IN MATHEMATICS[1]

1. WHEN I read your *Defence of the British Mathematicians*, I could not, Sir, but admire your courage in asserting with such undoubting assurance things so easily disproved. This to me seemed unaccountable, till I reflected on what you say (p. 32), when, upon my having appealed to every thinking reader, whether it be possible to frame any clear conception of Fluxions, you express yourself in the following manner—'Pray, Sir, who are those thinking readers you appeal to? Are they geometricians, or persons wholly ignorant of geometry? If the former, I leave it to them: if the latter, I ask, How well are they qualified to judge of the method of fluxions?' It must be acknowledged you seem by this dilemma secure in the favour of one part of your readers, and the ignorance of the other. I am nevertheless persuaded there are fair and candid men among the mathematicians. And for those who are not mathematicians, I shall endeavour so to unveil this mystery, and put the controversy between us in such a light as that every reader of ordinary sense and reflexion may be a competent judge thereof.

2. You express an extreme surprise and concern, 'that I should take so much pains to depreciate one of the noblest sciences, to disparage and traduce a set of learned men, whose labours so greatly conduce to the honour of this island (p. 5); to lessen the reputation and authority of Sir Isaac Newton and his followers, by shewing that they are not such masters of reason as they are generally presumed to be; and to depreciate the science they profess, by

[1] See Editor's Preface to the *Analyst*, p. 9.

demonstrating to the world that it is not of that clearness and certainty as is commonly imagined.' All which, you insist, 'appears very strange to you and the rest of that famous University, who plainly see of how great use mathematical learning is to mankind.' Hence you take occasion to declaim on the usefulness of mathematics in the several branches, and then to redouble your surprise and amazement (p. 12 and 20).—To all which declamation I reply, that it is quite beside the purpose. For, I allow, and always have allowed, its full claim of merit to whatever is useful and true in the mathematics: but that which is not so, the less it employs men's time and thoughts the better. And, after all you have said or can say, I believe the unprejudiced reader will think with me, that things obscure are not therefore sacred; and that it is no more a crime to canvass and detect unsound principles or false reasonings in mathematics than in any other part of learning.

3. You are, it seems, much at a loss to understand the usefulness, or tendency, or prudence of my attempt. I thought I had sufficiently explained this in the *Analyst*. But for your farther satisfaction shall here tell you it is very well known that several persons who deride Faith and Mysteries in Religion admit the doctrine of Fluxions for true and certain. Now, if it be shewn that fluxions are really most incomprehensible Mysteries, and that those who believe them to be clear and scientific do entertain an implicit faith in the author of that method[1]: will not this furnish a fair *argumentum ad hominem* against men who reject that very thing in religion which they admit in human learning? And is it not a proper way to abate the pride, and discredit the pretensions of those who insist upon clear ideas in points of faith, if it be shewn that they do without them even in science?

4. As to my timing this charge; why now and not before, since I had published hints thereof many years ago[2]? Surely I am obliged to give no account of this: if what hath been said in the *Analyst* be not sufficient. Suppose that I had not leisure, or that I did not think it expedient, or that I had no mind to it. When a man thinks fit to

[1] Also faith or trust in the fundamental principles of the modern analysis, notwithstanding their mysteriousness.

[2] In the *Principles*.

publish anything, either in mathematics or in any other part of learning, what avails it, or indeed what right hath any one to ask, Why at this or that time; in this or that manner; upon this or that motive? Let the reader judge if it suffice not that what I publish is true, and that I have a right to publish such truths when and how I please, in a free country.

5. I do not say that mathematicians, as such, are infidels; or that geometry is a friend to infidelity; which you untruly insinuate, as you do many other things; whence you raise topics for invective. But I say there are certain mathematicians who are known to be so; and that there are others who are not mathematicians who are influenced by a regard for their authority. Some, perhaps, who live in the University, may not be apprised of this: but the intelligent and observing reader, who lives in the world, and is acquainted with the humour of the times and the characters of men, is well aware there are too many that deride Mysteries and yet admire Fluxions; who yield that faith to a mere mortal which they deny to Jesus Christ, whose religion they make it their study and business to discredit. The owning this is not to own that men who reason well are enemies to religion, as you would represent it: on the contrary, I endeavour to shew that such men are defective in point of reason and judgment, and that they do the very thing they would seem to despise.

6. There are, I make no doubt, among the mathematicians many sincere believers in Jesus Christ. I know several such myself; but I addressed my *Analyst* to an infidel: and, on very good grounds, I supposed that, besides him, there were other deriders of faith who had nevertheless a profound veneration for fluxions; and I was willing to set forth the inconsistence of such men. If there be no such thing as infidels who pretend to knowledge in the modern analysis, I own myself misinformed, and shall gladly be found in a mistake; but even in that case, my remarks upon fluxions are not the less true; nor will it follow that I have no right to examine them on the foot of human science, even though religion were quite unconcerned, and though I had no end to serve but truth. But you are very angry (p. 13 and 14) that

I should enter the lists with reasoning infidels, and attack them upon their pretensions to science: and hence you take occasion to shew your spleen against the clergy. I will not take upon me to say that I know you to be a Minute Philosopher yourself; but I know the Minute Philosophers make just such compliments as you do to our church, and are just as angry as you can be at any who undertake to defend religion by reason. If we resolve all into faith, they laugh at us and our faith: and if we attempt to reason, they are angry at us: they pretend we get out of our province, and they recommend to us a blind implicit faith. Such is the inconsistence of our adversaries. But it is to be hoped there will never be wanting men to deal with them at their own weapons; and to shew they are by no means those masters of reason which they would fain pass for.

7. I do not say, as you would represent me, that we have no better reason for our religion than you have for fluxions: but I say that an infidel, who believes the doctrine of fluxions, acts a very inconsistent part in pretending to reject the Christian religion because he cannot believe what he doth not comprehend; or because he cannot assent without evidence; or because he cannot submit his faith to authority. Whether there are such infidels, I submit to the judgment of the reader. For my own part I make no doubt of it, having seen some shrewd signs thereof myself, and having been very credibly informed thereof by others. Nor doth this charge seem the less credible, for your being so sensibly touched, and denying it with so much passion. You, indeed, do not stick to affirm, that the persons who informed me are 'a pack of base, profligate, and impudent liars' (p. 27). How far the reader will think fit to adopt your passions, I cannot say; but I can truly say, the late celebrated Mr. Addison is one of the persons whom you are pleased to characterise in these modest and mannerly terms. He assured me that the infidelity of a certain noted mathematician, still living, was one principal reason assigned by a witty man of those times for his being an infidel[1]. Not

[1] Dr. (Sir Samuel) Garth, who died in January, 1719, a few months before Addison's death. Halley seems to be the 'noted mathematician' referred to.

that I imagine geometry disposeth men to infidelity: but that, from other causes, such as presumption, ignorance, or vanity, like other men geometricians also become infidels, and that the supposed light and evidence of their science gains credit to their infidelity.

8. You reproach me with calumny, detraction, and artifice (p. 15). You recommend such means as are innocent and just, rather than the criminal method of lessening or detracting from my opponents (Ibid.). You accuse me of the *odium theologicum*, the intemperate zeal of divines, that I do *stare super vias antiquas* (p. 13); with much more to the same effect. For all which charge I depend on the reader's candour, that he will not take your word, but read and judge for himself. In which case he will be able to discern (though he should be no mathematician) how passionate and unjust your reproaches are, and how possible it is for a man to cry out against calumny and practise it in the same breath. Considering how impatient all mankind are when their prejudices are looked into, I do not wonder to see you rail and rage at the rate you do. But if your own imagination be strongly shocked and moved, you cannot therefore conclude that a sincere endeavour to free a science, so useful and ornamental to human life, from those subtleties, obscurities, and paradoxes which render it inaccessible to most men, will be thought a criminal undertaking by such as are in their right mind. Much less can you hope that an illustrious Seminary of learned men, which hath produced so many free-spirited inquiries after truth, will at once enter into your passions, and degenerate into a nest of bigots.

9. I observe upon the inconsistency of certain infidel analysts. I remark some defects in the principles of the modern analysis. I take the liberty decently to dissent from Sir Isaac Newton. I propose some helps to abridge the trouble of mathematical studies, and render them more useful. What is there in all this that should make you declaim on the usefulness of practical mathematics? That should move you to cry out *Spain, inquisition, odium theologicum*? By what figure of speech do you extend what is said of the modern analysis to mathematics in general; or what is said of mathematical infidels to all

mathematicians; or the confuting an error in science to burning or hanging the authors? But it is nothing new or strange that men should choose to indulge their passions, rather than quit their opinions, how absurd soever. Hence the frightful visions and tragical uproars of bigoted men, be the subject of their bigotry what it will. A very remarkable instance of this you give (p. 27), where, upon my having said that a deference to certain mathematical infidels, as I was credibly informed, had been one motive to infidelity, you ask, with no small emotion—'For God's sake are we in England or in Spain?' 'Is this the language of a familiar who is whispering an inquisitor, &c.?' And the page before you exclaim in the following words—'Let us burn or hang up all the mathematicians in Great Britain, or halloo the mob upon them to tear them to pieces every mother's son of them, *Tros Rutulusve fuat*, laymen or clergymen, &c. Let us dig up the bodies of Dr. Barrow and Sir Isaac Newton, and burn them under the gallows.'

10. The reader need not be a mathematician to see how vain all this tragedy of yours is. And if he be as thoroughly satisfied as I am that the cause of fluxions cannot be defended by reason, he will be as little surprised as I am to see you betake yourself to the arts of all bigoted men, raising terror and calling in the passions to your assistance. Whether those rhetorical flourishes about the inquisition and the gallows are not quite ridiculous, I leave to be determined by the reader. Who will also judge (though he should not be skilled in geometry) whether I have given the least grounds for this and a world of such-like declamation? And whether I have not constantly treated those celebrated writers with all proper respect, though I take the liberty in certain points to differ from them?

11. As I heartily abhor an inquisition in faith, so I think you have no right to erect one in science. At the time of writing your *Defence* you seem to have been overcome with passion. But, now you may be supposed cool, I desire you to reflect whether it be not wrote in the true spirit of an inquisitor? Whether this becomes a person so exceeding delicate himself upon that point? And whether your brethren the analysts will think them-

selves honoured or obliged by you, for having defended their doctrine in the same manner as any declaiming bigot would defend transubstantiation? The same false colours, the same intemperate sallies, and the same indignation against common sense!

12. In a matter of mere science, where authority hath nothing to do, you constantly endeavour to overbear me with authorities, and load me with envy. If I see a sophism in the writings of a great author, and, in compliment to his understanding, suspect he could hardly be quite satisfied with his own demonstration; this sets you on declaiming for several pages. It is pompously set forth, as a criminal method of detracting from great men; as a concerted project to lessen their reputation, as making them pass for impostors. If I publish my free thoughts, which I have as much right to publish as any other man, it is imputed to rashness, and vanity, and the love of opposition. Though perhaps my late publication, of what had been hinted twenty-five years ago, may acquit me of this charge in the eyes of an impartial reader. But when I consider the perplexities that beset a man who undertakes to defend the doctrine of fluxions, I can easily forgive your anger.

13. Two sorts of learned men there are. One who candidly seek truth by rational means: these are never averse to have their principles looked into, and examined by the test of reason. Another sort there is who learn by *rote* a set of principles and a way of thinking which happen to be in vogue. These betray themselves by their anger and surprise, whenever their principles are freely canvassed. But you must not expect that your reader will make himself a party to your passions or your prejudices. I freely own that Sir Isaac Newton hath shewed himself an extraordinary mathematician, a profound naturalist, a person of the greatest abilities and erudition. Thus far I can readily go; but I cannot go the lengths that you do. I shall never say of him as you do, *Vestigia pronus adoro* (p. 70). This same adoration that you pay to him, I will pay only to truth.

14. You may, indeed, yourself be an idolater of whom you please. But then you have no right to insult and exclaim at other men, because they do not adore your

idol. Great as Sir Isaac Newton was, I think he hath, on more occasions than one, shewed himself not to be infallible. Particularly, his demonstration of the doctrine of fluxions I take to be defective; and I cannot help thinking that he was not quite pleased with it himself. And yet this doth not hinder but the method may be useful, considered as an art of invention. You, who are a mathematician, must acknowledge there have been divers such methods admitted in mathematics, which are not demonstrative. Such, for instance, are the inductions of Dr. Wallis, in his Arithmetic of Infinites; and such what Harriot, and, after him, Des Cartes, have wrote concerning the roots of affected equations. It will not, nevertheless, thence follow that those methods are useless; but only that they are not to be allowed of as premises in a strict demonstration.

15. No great name upon earth shall ever make me accept things obscure for clear, or sophisms for demonstrations. Nor may you ever hope to deter me from freely speaking what I freely think, by those arguments *ab invidia* which at every turn you employ against me. You represent yourself (p. 52) as a man 'whose highest ambition is in the lowest degree to imitate Sir Isaac Newton.' It might, perhaps, have suited better with your appellation of *Philalethes*, and been altogether as laudable, if your highest ambition had been to discover truth. Very consistently with the character you give of yourself, you speak of it as a sort of crime (p. 70) to think it possible you should ever 'see farther, or go beyond Sir Isaac Newton.' And I am persuaded you speak the sentiments of many more besides yourself. But there are others who are not afraid to sift the principles of human science, who think it no honour to imitate the greatest man in his defects, who even think it no crime to desire to know, not only beyond Sir Isaac Newton, but beyond all mankind. And whoever thinks otherwise, I appeal to the reader whether he can properly be called a philosopher.

16. Because I am not guilty of your mean idolatry, you inveigh against me as a person conceited of my own abilities; not considering that a person of less abilities may know more on a certain point than one of greater;

not considering that a purblind eye, in a close and narrow view, may discern more of a thing than a much better eye in a more extensive prospect[1]; not considering that this is to fix a *ne plus ultra*, to put a stop to all future inquiries; lastly, not considering that this is in fact, so much as in you lies, converting the republic of letters into an absolute monarchy, that it is even introducing a kind of philosophic popery among a free people.

17. I have said (and I venture still to say) that a fluxion is incomprehensible: that second, third, and fourth fluxions are yet more incomprehensible: that it is not possible to conceive a simple infinitesimal: that it is yet less possible to conceive an infinitesimal of an infinitesimal, and so onward[2]. What have you to say in answer to this? Do you attempt to clear up the notion of a fluxion or a difference? Nothing like it. You only 'assure me (upon your bare word) from your own experience, and that of several others whom you could name, that the doctrine of fluxions may be clearly conceived and distinctly comprehended; and that if I am puzzled about it and do not understand it, yet others do.' But can you think, Sir, I shall take your word, when I refuse to take your Master's?

18. Upon this point every reader of common sense may judge as well as the most profound mathematician. The simple apprehension of a thing defined is not made more perfect by any subsequent progress in mathematics. What any man evidently knows, he knows as well as you or Sir Isaac Newton. And every one can know whether the object of this method be (as you would have us think) clearly conceivable. To judge of this no depth of science is requisite, but only a bare attention to what passes in his own mind. And the same is to be understood of all definitions in all sciences whatsoever. In none of which can it be supposed that a man of sense and spirit will take any definition or principle upon trust, without sifting it to the bottom, and trying how far he can or he cannot conceive it. This is the course I have taken, and shall take, however you and your brethren may declaim against it, and place it in the most invidious light.

19. It is usual with you to admonish me to look over

[1] So *Principles*, Introduction, sect. 5.

[2] [*Analyst*, sect. 4, 5, 6, &c.]—AUTHOR.

a second time, to consult, examine, weigh the words of Sir Isaac. In answer to which I will venture to say that I have taken as much pains as (I sincerely believe) any man living to understand that great author, and to make sense of his principles. No industry, nor caution, nor attention, I assure you, have been wanting on my part. So that, if I do not understand him, it is not my fault but my misfortune. Upon other subjects you are pleased to compliment me with depth of thought and uncommon abilities (p. 5 and 84). But I freely own, I have no pretence to those things. The only advantage I pretend to is that I have always thought and judged for myself. And, as I never had a master in mathematics, so I fairly followed the dictates of my own mind in examining and censuring the authors I read upon that subject, with the same freedom that I used upon any other; taking nothing upon trust, and believing that no writer was infallible. And a man of moderate parts, who takes this painful course in studying the principles of any science, may be supposed to walk more surely than those of greater abilities, who set out with more speed and less care.

20. What I insist on is, That the idea of a fluxion, simply considered, is not at all improved or amended by any progress, though ever so great, in the analysis: neither are the demonstrations of the general rules of that method at all cleared up by applying them. The reason of which is, because, in operating or calculating, men do not return to contemplate the original principles of the method, which they constantly presuppose, but are employed in working, by notes and symbols denoting the fluxions supposed to have been at first explained, and according to rules supposed to have been at first demonstrated. This I say to encourage those who are not far gone in these studies, to use intrepidly their own judgment, without a blind or a mean deference to the best of mathematicians, who are no more qualified than they are to judge of the simple apprehension, or the evidence of what is delivered in the first elements of the method;—men by farther and frequent use or exercise becoming only more accustomed to the symbols and rules, which doth not make either the foregoing notions more clear, or the foregoing proofs more perfect. Every reader

of common sense, that will but use his faculties, knows as well as the most profound analyst what idea he frames or can frame of velocity without motion, or of motion without extension, of magnitude which is neither finite nor infinite, or of a quantity having no magnitude which is yet divisible, of a figure where there is no space, of proportion between nothings, or of a real product from nothing multiplied by something. He need not be far gone in geometry to know that obscure principles are not to be admitted in demonstration; that if a man destroys his own hypothesis, he at the same time destroys what was built upon it: that error in the premises, not rectified, must produce error in the conclusion.

21. In my opinion the greatest men have their prejudices. Men learn the elements of science from others: and every learner hath a deference more or less to authority, especially the young learners, few of that kind caring to dwell long upon principles, but inclining rather to take them upon trust: and things early admitted by repetition become familiar: and this familiarity at length passeth for evidence. Now to me it seems there are certain points tacitly admitted by mathematicians which are neither evident nor true. And such points or principles ever mixing with their reasonings do lead them into paradoxes and perplexities. If the great author of the fluxionary method was early imbued with such notions it would only shew he was a man. And if, by virtue of some latent error in his principles, a man be drawn into fallacious reasonings, it is nothing strange that he should take them for true: and, nevertheless, if, when urged by perplexities and uncouth consequences, and driven to arts and shifts, he should entertain some doubt thereof, it is no more than one may naturally suppose might befall a great genius grappling with an insuperable difficulty: which is the light in which I have placed Sir Isaac Newton[1]. Hereupon you are pleased to remark that I represent the great author not only as a weak but an ill man, as a deceiver and an impostor. The reader will judge how justly.

22. As to the rest of your colourings and glosses, your

[1] [*Analyst*, sect. 18.]—AUTHOR.

reproaches and insults and outcries, I shall pass them over, only desiring the reader not to take your word, but read what I have written, and he will want no other answer. It hath been often observed that the worst cause produceth the greatest clamour; and indeed you are so clamorous throughout your defence that the reader, although he should be no mathematician, provided he understands common sense, and hath observed the ways of men, will be apt to suspect that you are in the wrong. It should seem, therefore, that your brethren the analysts are but little obliged to you for this new method of declaiming in mathematics. Whether they are more obliged by your reasoning I shall now examine.

23. You ask me (p. 32) where I find Sir Isaac Newton using such expressions as the velocities of velocities, the second, third, and fourth velocities, &c. This you set forth as a pious fraud and unfair representation.—I answer, that if according to Sir Isaac Newton a fluxion be the velocity of an increment, then according to him I may call the fluxion of a fluxion the velocity of a velocity. But for the truth of the antecedent see his Introduction to the Quadrature of Curves, where his own words are—*Motuum vel incrementorum velocitates nominando fluxiones.* See also the second lemma of the second book of his Mathematical Principles of Natural Philosophy, where he expresseth himself in the following manner—*Velocitates incrementorum ac decrementorum, quas etiam, motus, mutationes, et fluxiones quantitatum nominare licet.* And that he admits fluxions of fluxions, or second, third, fourth fluxions, &c., see his Treatise of the Quadrature of Curves. I ask now, Is it not plain that if a fluxion be a velocity, then the fluxion of a fluxion may, agreeably thereunto, be called the velocity of a velocity? In like manner, if by a fluxion is meant a nascent augment, will it not then follow that the fluxion of a fluxion or second fluxion is the nascent augment of a nascent augment? Can anything be plainer? Let the reader now judge who is unfair.

24. I had observed that the great author had proceeded illegitimately, in obtaining the fluxion or moment of the rectangle of two flowing quantities; and that he did not fairly get rid of the rectangle of the moments.—In answer

to this you allege that the error arising from the omission of such rectangle (allowing it to be an error) is so small that it is insignificant. This you dwell upon and exemplify to no other purpose but to amuse your reader and mislead him from the question; which in truth is not concerning the accuracy of computing or measuring in practice, but concerning the accuracy of the reasoning in science. That this was really the case, and that the smallness of the practical error nowise concerns it, must be so plain to any one who reads the *Analyst* that I wonder how you could be ignorant of it.

25. You would fain persuade your reader that I make an absurd quarrel against errors of no significancy in practice, and represent mathematicians as proceeding blindfold in their approximations, in all which I cannot help thinking there is on your part either great ignorance or great disingenuity. If you mean to defend the reasonableness and use of approximations or of the method of indivisibles, I have nothing to say. But then you must remember this is not the doctrine of fluxions: it is none of that analysis with which I am concerned. That I am far from quarrelling at approximations in geometry is manifest from the thirty-third and fifty-third queries in the *Analyst*. And that the method of fluxions pretends to somewhat more than the method of indivisibles is plain; because Sir Isaac disclaims this method as not geometrical[1]. And that the method of fluxions is supposed accurate in geometrical rigour is manifest to whoever considers what the great author writes about it; especially in his Introduction to the Quadrature of Curves, where he saith, *In rebus mathematicis errores quam minimi non sunt contemnendi.* Which expression you have seen quoted in the *Analyst*, and yet you seem ignorant thereof, and indeed of the very end and design of the great author of this his invention of fluxions.

26. As oft as you talk of finite quantities inconsiderable in practice, Sir Isaac disowns your apology. *Cave*, saith he, *intellexeris finitas*. And, although quantities less than sensible may be of no account in practice, yet none of

[1] [See the Scholium at the end of the first section. Lib. I. *Phil. Nat. Prin. Math.*]—AUTHOR.

your masters, nor will even you yourself, venture to say they are of no account in theory and in reasoning. The application in gross practice is not the point questioned, but the rigour and justness of the reasoning. And it is evident that, be the subject ever so little, or ever so inconsiderable, this doth not hinder but that a person treating thereof may commit very great errors in logic; which logical errors are in nowise to be measured by the sensible or practical inconveniences thence arising, which, perchance, may be none at all. It must be owned that, after you have misled and amused your less qualified reader (as you call him), you return to the real point in controversy, and set yourself to justify Sir Isaac's method of getting rid of the above-mentioned rectangle. And here I must entreat the reader to observe how fairly you proceed.

27. First then you affirm (p. 44), 'that neither in the demonstration of the rule for finding the fluxion of the rectangle of two flowing quantities, nor in anything preceding or following it, is any mention, so much as once, made of the increment of the rectangle of such flowing quantities.' Now I affirm the direct contrary. For, in the very passage by you quoted in this same page, from the first case of the second lemma of the second book of Sir Isaac's Principles, beginning with *Rectangulum quodvis motu perpetuo auctum*, and ending with *igitur laterum incrementis totis a et b generatur rectanguli incrementum* $aB+bA$. *Q.E.D.*—in this very passage, I say, is express mention made of the increment of such rectangle. As this is matter of fact, I refer it to the reader's own eyes. Of what rectangle have we here the increment? Is it not plainly of that whose sides have a and b for their *incrementa tota*, that is, of AB? Let any reader judge whether it be not plain from the words, the sense, and the context, that the great author in the end of his demonstration understands his *incrementum* as belonging to the *rectangulum quodvis* at the beginning. Is not the same also evident from the very lemma itself prefixed to the demonstration? The sense whereof is (as the author there explains it), that if the moments of the flowing quantities A and B are called a and b, then the *momentum vel mutatio geniti rectanguli* AB will be $aB+bA$. Either therefore

the conclusion of the demonstration is not the thing which was to be demonstrated, or the *rectanguli incrementum* $aB+bA$ belongs to the rectangle AB.

28. All this is so plain that nothing can be more so; and yet you would fain perplex this plain case by distinguishing between an increment and a moment. But it is evident to every one who has any notion of demonstration that the *incrementum* in the conclusion must be the *momentum* in the lemma; and to suppose it otherwise is no credit to the author. It is in effect supposing him to be one who did not know what he would demonstrate. But let us hear Sir Isaac's own words: *Earum (quantitatum scilicet fluentium) incrementa vel decrementa momentanea sub nomine momentorum intelligo.* And you observe yourself that he useth the word *moment* to signify either an increment or decrement. Hence, with an intention to puzzle me, you propose the increment and decrement of AB, and ask which of these I would call the moment? The case you say is difficult. My answer is very plain and easy, to wit, Either of them. You, indeed, make a different answer; and from the author's saying that by a moment he understands either the momentaneous increment or decrement of the flowing quantities, you would have us conclude, by a very wonderful inference, that his moment is neither the increment nor decrement thereof. Would it not be as good an inference, because a number is either odd or even, to conclude it is neither? Can any one make sense of this? Or can even yourself hope that this will go down with the reader, how little soever qualified? It must be owned, you endeavour to intrude this inference on him, rather by mirth and humour than by reasoning. You are merry, I say, and (p. 46) represent the two mathematical quantities as pleading their rights, as tossing up cross and pile, as disputing amicably. You talk of their claiming preference, their agreeing, their boyishness, and their gravity. And after this ingenious digression you address me in the following words—Believe me, there is no remedy, you must acquiesce. But my answer is that I will neither believe you nor acquiesce; there is a plain remedy in common sense; and, to prevent surprise, I desire the reader always to keep the controverted point in view, to examine your reasons, and be

cautious how he takes your word, but most of all when you are positive, or eloquent, or merry.

29. A page or two after, you very candidly represent your case to be that of an ass between two bottles of hay: it is your own expression. The cause of your perplexity is that you know not whether the velocity of AB increasing, or of AB decreasing is to be esteemed the fluxion, or proportional to the moment of the rectangle. My opinion, agreeably to what hath been premised, is that either may be deemed the fluxion. But you tell us (p. 49) 'that you think, the venerable ghost of Sir Isaac Newton whispers you, the velocity you seek for is neither the one nor the other of these, but it is the velocity which the flowing rectangle hath not while it is greater or less than AB, but at that very instant of time that it is AB.' For my part, in the rectangle AB considered simply in itself, without either increasing or diminishing, I can conceive no velocity at all. And if the reader is of my mind, he will not take either your word, or even the word of a ghost, how venerable soever, for velocity without motion. You proceed and tell us that, in like manner, the moment of the rectangle is neither its increment or decrement. This you would have us believe on the authority of his ghost, in direct opposition to what Sir Isaac himself asserted when alive. *Incrementa* (saith he) *vel decrementa momentanea sub nomine momentorum intelligo: ita ut incrementa pro momentis additititis seu affirmativis, ac decrementa pro subductitiis seu negativis habeantur.* I will not in your style bid the reader believe me, but believe his eyes.

30. To me it verily seems that you have undertaken the defence of what you do not understand. To mend the matter, you say, 'you do not consider AB as lying at either extremity of the moment, but as extended to the middle of it; as having acquired the one half of the moment, and as being about to acquire the other; or, as having lost one half of it, and being about to lose the other.'—Now, in the name of truth, I entreat you to tell what this moment is, to the middle whereof the rectangle is extended? This moment, I say, which is acquired, which is lost, which is cut in two, or distinguished into halves? Is it a finite quantity, or an infinitesimal, or a mere limit, or nothing at all? Take it in what sense

you will, I cannot make your defence either consistent or intelligible. For, if you take it in either of the two former senses, you contradict Sir Isaac Newton. And, if you take it in either of the latter, you contradict common sense; it being plain, that what hath no magnitude, or is no quantity, cannot be divided. And here I must entreat the reader to preserve his full freedom of mind entire, and not weakly suffer his judgment to be overborne by your imagination and your prejudices, by great names and authorities, by ghosts and visions, and above all by that extreme satisfaction and complacency with which you utter your strange conceits; if words without a meaning may be called so. After having given this unintelligible account, you ask with your accustomed air, 'What say you, Sir? Is this a just and legitimate reason for Sir Isaac's proceeding as he did? I think you must acknowledge it to be so.' But, alas! I acknowledge no such thing. I find no sense or reason in what you say. Let the reader find it if he can.

31. In the next place (p. 50), you charge me with want of caution. 'Inasmuch (say you) as that quantity which Sir Isaac Newton, through his whole lemma, and all the several cases of it, constantly calls a *moment*, without confining it to be either an increment or decrement, is by you inconsiderately and arbitrarily, and without any shadow of reason given, supposed and determined to be an increment.'—To which charge I reply, that it is as untrue as it is peremptory. For that, in the foregoing citation from the first case of Sir Isaac's lemma, he expressly determines it to be an increment. And, as this particular instance or passage was that which I objected to, it was reasonable and proper for me to consider the moment in the same light. But, take it increment or decrement as you will, the objections still lie, and the difficulties are equally insuperable. You then proceed to extol the great author of the fluxionary method, and to bestow some *brusqueries* upon those who unadvisedly dare to differ from him. To all which I shall give no answer.

32. Afterwards to remove (as you say) all scruple and difficulty about this affair, you observe that the moment of the rectangle determined by Sir Isaac Newton, and the increment of the rectangle determined by me are perfectly

and exactly equal, supposing *a* and *b* to be diminished *ad infinitum*: and, for proof of this, you refer to the first lemma of the first section of the first book of Sir Isaac's Principles. I answer that if *a* and *b* are real quantities, then *a b* is something, and consequently makes a real difference: but if they are nothing, then the rectangles whereof they are coefficients become nothing likewise: and consequently the *momentum* or *incrementum*, whether Sir Isaac's or mine, are in that case nothing at all. As for the above-mentioned lemma, which you refer to, and which you wish I had consulted sooner, both for my own sake and for yours; I tell you I had long since consulted and considered it. But I very much doubt whether you have sufficiently considered that lemma, its demonstration, and its consequences. For, however that way of reasoning may do in the method of *exhaustions*, where quantities less than assignable are regarded as nothing; yet, for a fluxionist writing about momentums to argue that quantities must be equal because they have no assignable difference seems the most injudicious step that could be taken: it is directly demolishing the very doctrine you would defend. For, it will thence follow that all homogeneous momentums are equal, and consequently the velocities, mutations, or fluxions, proportional thereto, are all likewise equal. There is, therefore, only one proportion of equality throughout, which at once overthrows the whole system you undertake to defend. Your moments (I say) not being themselves assignable quantities, their differences cannot be assignable: and, if this be true, by that way of reasoning it will follow, they are all equal; upon which supposition you cannot make one step in the method of fluxions. It appears from hence, how unjustly you blame me (p. 32) for omitting to give any account of that first section of the first book of the *Principia*, wherein (you say) the foundation of the method of fluxions is geometrically demonstrated and largely explained, and difficulties and objections against it are clearly solved. All which is so far from being true that the very first and fundamental lemma of that section is incompatible with and subversive of the doctrine of fluxions. And, indeed, who sees not that a demonstration *ad absurdum more veterum*, proceeding on a supposition that every difference must be some given quantity, cannot be admitted

in, or consist with, a method wherein quantities, less than any given, are supposed really to exist, and be capable of division?

33. The next point you undertake to defend is that method for obtaining a rule to find the fluxion of any power of a flowing quantity, which is delivered in his Introduction to the Quadratures, and considered in the *Analyst*[1]. And here the question between us is, whether I have rightly represented the sense of those words, *evanescant jam augmenta illa*, in rendering them, 'let the increments vanish,' i. e. let the increments be nothing, or let there be no increments? This you deny; but, as your manner is, instead of giving a reason you declaim. I, on the contrary, affirm, the increments must be understood to be quite gone, and absolutely nothing at all. My reason is, because without that supposition you can never bring the quantity or expression

$$nx^{n-1}+\frac{nn-n}{2}ox^{n-2}+\text{\&c. down to } nx^{n-1},$$

the very thing aimed at by supposing the evanescence. Say whether this be not the truth of the case? Whether the former expression is not to be reduced to the latter? And whether this can possibly be done so long as o is supposed a real quantity? I cannot indeed say you are scrupulous about your affirmations, and yet I believe that even you will not affirm this; it being most evident, that the product of two real quantities is something real; and that nothing real can be rejected either according to the ἀκρίβεια of geometry, or according to Sir Isaac's own Principles; for the truth of which I appeal to all who know anything of these matters. Further, by *evanescant* must either be meant, let them (the increments) vanish and become nothing, in the obvious sense, or else let them become infinitely small. But that this latter is not Sir Isaac's sense is evident from his own words in the very same page, that is, in the last of his Introduction to the Quadratures, where he expressly saith, *volui ostendere quod in methodo fluxionum non opus sit figuras infinite parvas in geometriam introducere.* Upon the whole, you

[1] [Sect. 13, 14, &c.]—AUTHOR.

seem to have considered this affair so very superficially as greatly to confirm me in the opinion you are so angry with, to wit, that Sir Isaac's followers are much more eager in applying his method than accurate in examining his principles. You raise a dust about evanescent augments, which may perhaps amuse and amaze your reader, but I am much mistaken if it ever instructs or enlightens him. For, to come to the point, those evanescent augments either are real quantities, or they are not. If you say they are; I desire to know how you get rid of the rejectaneous quantity? If you say they are not; you indeed get rid of those quantities in the composition whereof they are coefficients; but then you are of the same opinion with me, which opinion you are pleased to call (p. 58) 'a most palpable, inexcusable, and unpardonable blunder,' although it be a truth most palpably evident.

34. Nothing, I say, can be plainer to any impartial reader than that by the evanescence of augments in the above-cited passage, Sir Isaac means their being actually reduced to nothing. But, to put it out of all doubt that this is the truth, and to convince even you, who shew so little disposition to be convinced, I desire you to look into his *Analysis per Æquationes Infinitas* (p. 20), where, in his preparation for demonstrating the first rule for the squaring of simple curves, you will find that, on a parallel occasion, speaking of an augment which is supposed to vanish, he interprets the word *evanescere* by *esse nihil.* Nothing can be plainer than this, which at once destroys your defence. And yet, plain as it is, I despair of making you acknowledge it; though I am sure you feel it, and the reader if he useth his eyes must see it. The words *evanescere sive esse nihil* do (to use your own expression) stare us in the face. Lo! This is what you call (p. 56) 'so great, so unaccountable, so horrid, so truly Bœotian a blunder,' that, according to you, it was not possible Sir Isaac Newton could be guilty of it. For the future, I advise you to be more sparing of hard words; since, as you incautiously deal them about, they may chance to light on your friends as well as your adversaries. As for my part, I shall not retaliate. It is sufficient to say you are mistaken. But I can easily pardon your mistakes. Though, indeed, you tell me, on this very occasion, that I must expect no

quarter from Sir Isaac's followers. And I tell you that I neither expect nor desire any. My aim is truth. My reasons I have given. Confute them, if you can. But think not to overbear me either with authorities or harsh words. The latter will recoil upon yourselves. The former, in a matter of science, are of no weight with indifferent readers; and, as for bigots, I am not concerned about what they say or think.

35. In the next place you proceed to declaim upon the following passage, taken from the seventeenth section of the *Analyst*. 'Considering the various arts and devices used by the great author of the fluxionary method; in how many lights he placeth his fluxions; and in what different ways he attempts to demonstrate the same point: one would be inclined to think he was himself suspicious of the justness of his own demonstrations.' This passage you complain of as very hard usage of Sir Isaac Newton. You declaim copiously, and endeavour to shew that placing the same point in various lights is of great use to explain it; which you illustrate with much rhetoric. But the fault of that passage is not the hard usage it contains: but, on the contrary, that it is too modest, and not so full and expressive of my sense as perhaps it should have been. Would you like it better if I should say—'The various *inconsistent* accounts which this great author gives of his momentums and his fluxions may convince every intelligent reader that he had no clear and steady notions of them, without which there can be no demonstration?' I own frankly that I see no clearness or consistence in them. You tell me, indeed, in Miltonic verse, that the fault is in my own eyes,

> 'So thick a drop serene has quench'd their orbs,
> Or dim suffusion veil'd.'

At the same time you acknowledge yourself obliged for those various lights which have enabled you to understand his doctrine. But as for me, who do not understand it, you insult me, saying: 'For God's sake, what is it you are offended at, who do not still understand him?' May not I answer, that I am offended for this very reason—because I cannot understand him or make sense of what he says? You say to me that I am all in the dark.

I acknowledge it, and entreat you who see so clearly to help me out.

36. You, Sir, with the bright eyes, be pleased to tell me, whether Sir Isaac's momentum be a finite quantity, or an infinitesimal, or a mere limit? If you say a finite quantity: be pleased to reconcile this with what he saith in the scholium of the second lemma of the first section of the first book of his Principles: *Cave intelligas quantitates magnitudine determinatas, sed cogita semper diminuendas sine limite.* If you say, an infinitesimal: reconcile this with what is said in his Introduction to the Quadratures: *Volui ostendere quod in methodo fluxionum non opus sit figuras infinite parvas in geometriam inducere.* If you should say, it is a mere limit; be pleased to reconcile this with what we find in the first case of the second lemma in the second book of his Principles: *Ubi de lateribus A et B deerant momentorum dimidia, &c.*—where the moments are supposed to be divided. I should be very glad a person of such a luminous intellect would be so good as to explain whether by fluxions we are to understand the nascent or evanescent quantities themselves, or their motions, or their velocities, or simply their proportions: and, having interpreted them in what sense you will, that you would then condescend to explain the doctrine of second, third, and fourth fluxions, and shew it to be consistent with common sense if you can. You seem to be very sanguine when you express yourself in the following terms: 'I do assure you, Sir, from my own experience, and that of many others whom I could name, that the doctrine may be clearly conceived and distinctly comprehended.' (p. 31.) And it may be uncivil not to believe what you so solemnly affirm, from your own experience. But I must needs own I should be better satisfied of this, if, instead of entertaining us with your rhetoric, you would vouchsafe to reconcile those difficulties, and explain those obscure points above mentioned. If either you, or any one of those many whom you could name will but explain to others what you so clearly conceive yourselves, I give you my word that several will be obliged to you who, I may venture to say, understand those matters no more than myself. But, if I am not much mistaken, you and your friends will modestly decline this task.

37. I have long ago done what you so often exhort me to do—diligently read and considered the several accounts of this doctrine given by the great author in different parts of his writings; and upon the whole I could never make it out to be consistent and intelligible. I was even led to say that 'one would be inclined to think he was himself suspicious of the justness of his own demonstrations; and that he was not enough pleased with any one notion steadily to adhere to it.' After which I added, 'Thus much is plain, that he owned himself satisfied concerning certain points, which nevertheless he could not undertake to demonstrate to others.' (See the seventeenth section of the *Analyst*.) It is one thing when a doctrine is placed in various lights; and another when the principles and notions are shifted. When new devices are introduced and substituted for others, a doctrine instead of being illustrated may be explained away. Whether there be not something of this in the present case, I appeal to the writings of the great author—his *Methodus Rationum Primarum et Ultimarum*, his second lemma in the second book of his 'Principles,' his Introduction and Treatise of the Quadrature of Curves. In all which, it appears to me, there is not one uniform doctrine explained and carried throughout the whole, but rather sundry inconsistent accounts of this new Method, which still grows more dark and confused the more it is handled: I could not help thinking, the greatest genius might lie under the influence of false principles; and where the object and notions were exceeding obscure, he might possibly distrust even his own demonstrations. 'At least thus much seemed plain, that Sir Isaac had sometimes owned himself satisfied, where he could not demonstrate to others. In proof whereof I mentioned his letter to Mr. Collins; hereupon you tell me: there is a great deal of difference between saying, I cannot undertake to prove a thing, and I will not undertake it.'—But, in answer to this, I desire you will be pleased to consider that I was not making a precise extract out of that letter, in which the very words of Sir Isaac should alone be inserted. But I made my own remark and inference from what I remembered to have read in that letter; where, speaking of a certain mathematical matter, Sir Isaac expresseth himself in the following terms:

'It is plain to me by the fountain I draw it from, though I will not undertake to prove it to others.' Now, whether my inference may not be fairly drawn from those words of Sir Isaac Newton, and whether the difference as to the sense be so great between *will* and *can* in that particular case, I leave to be determined by the reader.

38. In the next paragraph you talk big but prove nothing. You speak of driving out of intrenchments, of sallying, and attacking, and carrying by assault; of slight and untenable works, of a new-raised and undisciplined militia, and of veteran regular troops. Need the reader be a mathematician to see the vanity of this paragraph? After this you employ (p. 65) your usual colouring, and represent the great author of the Method of Fluxions 'as a good old gentleman fast asleep, and snoring in his easy chair; while dame Fortune is bringing him her apron full of beautiful theorems and problems, which he never knows or thinks of.' This you would have pass for a consequence of my notions.—But I appeal to all those who are ever so little knowing in such matters, whether there are not divers fountains of experiment, induction, and analogy, whence a man may derive and satisfy himself concerning the truth of many points in mathematics and mechanical philosophy, although the proofs thereof afforded by the modern analysis should not amount to demonstration? I further appeal to the conscience of all the most profound mathematicians, whether they can, with perfect acquiescence of mind, free from all scruple, apply any proposition merely upon the strength of a demonstration involving second or third fluxions, without the aid of any such experiment, or analogy, or collateral proof whatsoever? Lastly, I appeal to the reader's own heart, whether he cannot clearly conceive a medium between being fast asleep and demonstrating?—But, you will have it that I represent Sir Isaac's conclusions as coming out right, because one error is compensated by another contrary and equal error, which perhaps he never knew himself nor thought of: that by a twofold mistake he arrives though not at science yet at truth: that he proceeds blindfold, &c. All which is untruly said by you, who have misapplied to Sir Isaac what was intended for the Marquis

de l'Hospital[1] and his followers; for no other end (as I can see) but that you may have an opportunity to draw that ingenious portraiture of Sir Isaac Newton and dame Fortune, as will be manifest to whoever reads the *Analyst.*

39. You tell me (p. 70) if I think fit to persist in asserting 'that this affair of a double error is entirely a new discovery of my own, which Sir Isaac and his followers never knew or thought of, that you have unquestionable evidence to convince me of the contrary, and that all his followers are already apprised that this very objection of mine was long since foreseen, and clearly and fully removed by Sir Isaac Newton, in the first section of the first book of his *Principia.*'—All which I do as strongly deny as you affirm. And I do aver that this is an unquestionable proof of the matchless contempt which you, *Philalethes,* have for truth. And I do here publicly call upon you to produce that evidence which you pretend to have, and to make good that fact which you so confidently affirm. And, at the same time, I do assure the reader that you never will, nor can.

40. If you defend Sir Isaac's notions, as delivered in his *Principia,* it must be on the rigorous foot of rejecting nothing, neither admitting nor casting away infinitely small quantities. If you defend the Marquis, whom you also style your Master, it must be on the foot of admitting that there are infinitesimals, that they may be rejected, that they are nevertheless real quantities, and themselves infinitely subdivisible. But you seem to have grown giddy with passion, and in the heat of controversy to have mistaken and forgot your part. I beseech you, Sir, to consider that the Marquis (whom alone, and not Sir Isaac, this double error in finding the subtangent doth concern) rejects indeed infinitesimals, but not on the foot that you do, to wit, their being inconsiderable in practical geometry or mixed mathematics. But he rejects them in the accuracy of speculative knowledge: in which respect there may be great logical errors, although there should be no sensible mistake in practice; which, it seems, is what you cannot comprehend. He rejects them likewise

[1] A French mathematician, author of the *Analyse des Infiniment Petits,* born 1661, died 1704.

in virtue of a postulatum, which I venture to call rejecting them without ceremony. And, though he inferreth a conclusion accurately true, yet he doth it, contrary to the rules of logic, from inaccurate and false premises. And how this comes about, I have at large explained in the *Analyst*, and shewed in that particular case of tangents, that the rejectaneous quantity might have been a finite quantity of any given magnitude, and yet the conclusion have come out exactly the same way; and, consequently, that the truth of this method doth not depend on the reason assigned by the Marquis, to wit, the postulatum for throwing away infinitesimals; and, therefore, that he and his followers acted blindfold, as not knowing the true reason for the conclusions coming out accurately right, which I shew to have been the effect of a double error.

41. This is the truth of the matter, which you shamefully misrepresent and declaim upon, to no sort of purpose but to amuse and mislead your reader. For which conduct of yours throughout your remarks, you will pardon me if I cannot otherwise account, than from a secret hope that the reader of your *Defence* would never read the *Analyst*. If he doth, he cannot but see what an admirable method you take to defend your cause: how, instead of justifying the reasoning, the logic, or the theory of the case specified, which is the real point, you discourse of sensible and practical errors: and how all this is a manifest imposition upon the reader. He must needs see that I have expressly said, 'I have no controversy except only about your logic and method: that I consider how you demonstrate; what objects you are conversant about; and whether you conceive them clearly.' That I have often expressed myself to the same effect, desiring the reader to remember, 'that I am only concerned about the way of coming at your theorems, whether it be legitimate or illegitimate, clear or obscure, scientific or tentative: that I have, on this very occasion, to prevent all possibility of mistake, repeated and insisted that I consider the geometrical analyst as a logician, i.e. so far forth as he reasons and argues; and his mathematical conclusions, not in themselves but in their premises; not as true or false, useful or insignificant, but as derived from such principles, and by such infer-

ences[1].' You affirm (and indeed what can you not affirm?) that the difference between the true subtangent and that found without any compensation is absolutely nothing at all. I profess myself of a contrary opinion. My reason is, because nothing cannot be divided into parts. But this difference is capable of being divided into any, or into more than any given number of parts; for the truth of which consult the Marquis de l'Hospital. And, be the error in fact or in practice ever so small, it will not thence follow that the error in reasoning, which is what I am alone concerned about, is one whit the less, it being evident that a man may reason most absurdly about the minutest things.

42. Pray answer me fairly, once for all, whether it be your opinion that whatsoever is little and inconsiderable enough to be rejected without inconvenience in practice, the same may in like manner be safely rejected and overlooked in theory and demonstration. If you say *No*, it will then follow that all you have been saying here and elsewhere, about yards, and inches, and decimal fractions, setting forth and insisting on the extreme smallness of the rejectaneous quantity, is quite foreign to the argument, and only a piece of skill to impose upon your reader. If you say *Yes*, it follows that you then give up at once all the orders of fluxions and infinitesimal differences; and so most imprudently turn all your sallies and attacks and veterans to your own overthrow. If the reader is of my mind, he will despair of ever seeing you get clear of this dilemma. The points in controversy have been so often and so distinctly noted in the *Analyst* that I very much wonder how you could mistake, if you had no mind to mistake. It is very plain, if you are in earnest, that you neither understand me nor your Masters. And what shall we think of other ordinary analysts, when it shall be found that even you, who like a champion step forth to defend their principles, have not considered them?

43. The impartial reader is entreated to remark throughout your whole performance how confident you are in asserting, and withal how modest in proving or explaining: how frequent it is with you to employ figures and tropes

[1] [*Analyst*, sect. 20.]—AUTHOR.

instead of reasons: how many difficulties proposed in the *Analyst* are discreetly overlooked by you, and what strange work you make with the rest: how grossly you mistake and misrepresent, and how little you practise the advice which you so liberally bestow. Believe me, Sir, I had long and maturely considered the principles of the modern analysis, before I ventured to publish my thoughts thereupon in the *Analyst*. And, since the publication thereof, I have myself freely conversed with mathematicians of all ranks, and some of the ablest professors, as well as made it my business to be informed of the opinions of others, being very desirous to hear what could be said towards clearing my difficulties or answering my objections. But, though you are not afraid or ashamed to represent the analysts as very clear and uniform in their conception of these matters, yet I do solemnly affirm (and several of themselves know it to be true) that I found no harmony or agreement among them, but the reverse thereof—the greatest dissonance, and even contrariety of opinions, employed to explain what after all seemed inexplicable.

44. Some fly to proportions between nothings. Some reject quantities because infinitesimal. Others allow only finite quantities, and reject them because inconsiderable. Others place the method of fluxions on a foot with that of *exhaustions*, and admit nothing new therein. Some maintain the clear conception of fluxions. Others hold they can demonstrate about things incomprehensible. Some would prove the algorism of fluxions by *reductio ad absurdum*; others *a priori*. Some hold the evanescent increments to be real quantities, some to be nothings, some to be limits. As many men, so many minds: each differing one from another, and all from Sir Isaac Newton. Some plead inaccurate expressions in the great author, whereby they would draw him to speak their sense; not considering that if he meant as they do, he could not want words to express his meaning. Others are magisterial and positive, say they are satisfied, and that is all; not considering that we, who deny Sir Isaac Newton's authority, shall not submit to that of his disciples. Some insist that the conclusions are true, and therefore the principles; not considering what hath been largely said

in the *Analyst*[1] on that head. Lastly, several (and those none of the meanest) frankly owned the objections to be unanswerable. All which I mention by way of antidote to your false colours: and that the unprejudiced inquirer after truth may see it is not without foundation that I call on the celebrated mathematicians of the present age to clear up these obscure analytics, and concur in giving to the public some consistent and intelligible account of their great Master: which if they do not, I believe the world will take it for granted that they cannot.

45. Having gone through your defence of the British mathematicians, I find, in the next place, that you attack me on a point of metaphysics, with what success the reader will determine. I had upon another occasion many years ago wrote against *abstract* general ideas[2]. In opposition to which, you declare yourself to adhere to the vulgar opinion, that neither geometry nor any other general science can subsist without general ideas (p. 74). This implies that I hold there are no general ideas. But I hold the direct contrary—that there are indeed general ideas, but not formed by abstraction, in the manner set forth by Mr. Locke. To me it is plain there is no consistent idea the likeness whereof may not really exist: whatsoever therefore is said to be somewhat which cannot exist, the idea thereof must be inconsistent. Mr. Locke acknowledgeth it doth require pains and skill to form his general idea of a triangle. He farther expressly saith it must be neither oblique nor rectangular, neither equilateral nor scalenum; but all and none of these at once. He also saith it is an idea wherein some parts of several different and inconsistent ideas are put together[3]. All this looks very like a contradiction. But, to put the matter past dispute, it must be noted that he affirms it to be somewhat imperfect *that cannot exist*; consequently, the idea thereof is impossible or inconsistent.

[1] [Sect. 19, 20, &c.]—AUTHOR.

[2] [Introduction to the *Treatise concerning the Principles of Human Knowledge.*]—AUTHOR. Note also Berkeley's reasonings in the first and second editions of *Alciphron*, and his withdrawal in the third edition against abstract general ideas.

[3] [*Essay on Human Understanding*, Bk. IV. ch. vii. § 9.]—AUTHOR.

46. I desire to know whether it is not possible for anything to exist which doth not include a contradiction: and, if it is, whether we may not infer that what cannot possibly exist, the same doth include a contradiction? I further desire to know, whether the reader can frame a distinct idea of anything that includes a contradiction? For my part, I cannot, nor consequently of the above-mentioned triangle; though you (who it seems know better than myself what I can do) are pleased to assure me of the contrary. Again, I ask whether that which it is above the power of man to form a *complete* idea of may not be called incomprehensible? And whether the reader can frame a complete idea of this imperfect impossible triangle? And, if not, whether it doth not follow that it is incomprehensible? It should seem that a distinct aggregate of a few consistent parts was nothing so difficult to conceive or impossible to exist; and that, therefore, your comment must be wide of the author's meaning. You give me to understand (p. 82) that this account of a general triangle was a trap which Mr. Locke set to catch fools. Who is caught therein let the reader judge.

47. It is Mr. Locke's opinion that every general name stands for a general *abstract* idea, which prescinds from the species or individuals comprehended under it. Thus, for example, according to him, the general name *colour* stands for an idea which is neither blue, red, green, nor any other particular colour, but somewhat distinct and abstracted from them all. To me it seems the word *colour* is only a more general name applicable to all and each of the particular colours: while the other specific names, as blue, red, green, and the like, are each restrained to a more limited signification. The same may be said of the word *triangle.* Let the reader judge whether this be not the case; and whether he can distinctly frame such an idea of colour as shall prescind from all the species thereof, or of a triangle which shall answer Mr. Locke's account, prescinding and abstracting from all the particular sorts of triangles, in the manner aforesaid.

48. I entreat my reader to think. For, if he doth not, he may be under some influence from your confident and

positive way of talking. But any one who thinks may, if I mistake not, plainly perceive that you are deluded, as it often happens, by mistaking the terms for ideas. Nothing is easier than to define in terms or words that which is incomprehensible in idea; forasmuch as any words can be either separated or joined as you please, but ideas always cannot. It is as easy to say a round square as an oblong square, though the former be inconceivable. If the reader will but take a little care to distinguish between the definition and the idea, between words or expressions and the conceptions of the mind, he will judge of the truth of what I now advance, and clearly perceive how far you are mistaken in attempting to illustrate Mr. Locke's doctrine, and where your mistake lies. Or, if the reader is minded to make a short work, he needs only at once to try whether, laying aside the words, he can frame in his mind the idea of an impossible triangle; upon which trial the issue of this dispute may be fairly put. This doctrine of abstract general ideas seemed to me a capital error, productive of numberless difficulties and disputes, that runs not only throughout Mr. Locke's book, but through most parts of learning. Consequently, my animadversions thereupon were not an effect of being inclined to carp or cavil at a single passage, as you would wrongfully insinuate, but proceeded from a love of truth, and a desire to banish, so far as in me lay, false principles and wrong ways of thinking, without respect of persons. And, indeed, though you and other party-men are violently attached to your respective Masters, yet I, who profess myself only attached to truth, see no reason why I may not as freely animadvert on Mr. Locke or Sir Isaac Newton, as they would on Aristotle or Des Cartes. Certainly the more extensive the influence of any error, and the greater the authority which supports it, the more it deserves to be considered and detected by sincere inquirers after knowledge.

49. In the close of your performance, you let me understand that your zeal for truth and the reputation of your Masters have occasioned your reprehending me with the utmost freedom. And it must be owned you have shewn a singular talent therein. But I am comforted under the

severity of your reprehensions, when I consider the weakness of your arguments, which, were they as strong as your reproofs, could leave no doubt in the mind of the reader concerning the matters in dispute between us. As it is, I leave him to reflect and examine by your light how clearly he is enabled to conceive a fluxion, or the fluxion of a fluxion, a part infinitely small subdivided into an infinity of parts, a nascent or evanescent increment, that which is neither something nor nothing, a triangle formed in a point, velocity without motion, and the rest of those *arcana* of the modern analysis. To conclude, I had some thoughts of advising you how to conduct yourself for the future, in return for the advice you have so freely imparted to me: but, as you think it becomes me rather to inform myself than instruct others, I shall, for my farther information, take leave to propose a few Queries to those learned gentlemen of Cambridge, whom you associate with yourself and represent as being equally surprised at the tendency of my *Analyst*.

50. I desire to know whether those who can neither demonstrate nor conceive the principles of the modern analysis, and yet give in to it, may not be justly said to have Faith, and be styled believers of Mysteries? Whether it is impossible to find among the physicians, mechanical philosophers, mathematicians, and philomathematicians, of the present age, some such believers, who yet deride Christians for their belief of mysteries? Whether with such men it is not a fair, reasonable, and legitimate method to use the *argumentum ad hominem*? And, being so, whether it ought to surprise either Christians or scholars? Whether in an age wherein so many pretenders to science attack the Christian religion, we may not be allowed to make reprisals, in order to shew that the irreligion of those men is not to be presumed an effect of deep and just thinking? Whether an attempt to detect false reasonings, and remedy defects in mathematics, ought to be ill received by mathematicians? Whether the introducing more easy methods, and more intelligible principles in any science should be discountenanced? Whether there may not be fair objections as well as cavils? And whether to inquire diligently into

the meaning of terms and the proof of propositions, not excepting against anything without assigning a reason, nor affecting to mistake the signification of words, or stick at an expression where the sense was clear, but considering the subject in all lights, sincerely endeavouring to find out any sense or meaning whatsoever, candidly setting forth what seems obscure and what fallacious, and calling upon those who profess the knowledge of such matters to explain them; whether, I say, such a proceeding can be justly called cavilling? Whether there be an *ipse dixit* erected? And, if so, when, where, by whom, and upon what authority? Whether, even where authority was to take place, one might not hope the mathematics, at least, would be excepted? Whether the chief end, in making mathematics so considerable a part of academical education, be not to form in the minds of young students habits of just and exact reasoning? And whether the study of abstruse and subtle matters can conduce to this end, unless they are well understood, examined, and sifted to the bottom? Whether, therefore, the bringing geometrical demonstrations to the severest test of reason should be reckoned a discouragement to the studies of any learned society? Whether, to separate the clear parts of things from the obscure, to distinguish the real principles whereon truths rest and whence they are derived, and to proportion the just measures of assent according to the various degrees of evidence, be a useless or unworthy undertaking? Whether the making more of an argument than it will bear, and placing it in an undue rank of evidence, be not the likely way to disparage it? Whether it may not be of some use, to provoke and stir up the learned professors to explain a part of mathematical learning which is acknowledged to be most profound, difficult, and obscure, and at the same time set forth by *Philalethes* and many others as the greatest instance that has ever been given of the extent of human abilities? Whether, for the sake of a great man's discoveries, we must adopt his errors? Lastly, whether in an age wherein all other principles are canvassed with the utmost freedom, the principles of Fluxions are to be alone excepted?

AN APPENDIX

CONCERNING

MR. WALTON'S VINDICATION OF SIR ISAAC NEWTON'S PRINCIPLES OF FLUXIONS[1].

1. I HAD no sooner considered the performance of *Philalethes*, but Mr. Walton's *Vindication of Fluxions* was put into my hands. As this Dublin professor gleans after the *Cantabrigian*[2], only endeavouring to translate a few passages from Sir Isaac Newton's *Principia*, and enlarge on a hint or two of *Philalethes*, he deserves no particular notice. It may suffice to advertise the reader that the foregoing *Defence* contains a full and explicit answer to Mr. Walton, as he will find, if he thinks it worth his pains to read what this gentleman hath written, and compare it therewith: particularly with sect. 18, 20, 30, 32–36, 43. It is not, I am sure, worth mine to repeat the same things, or confute the same notions twice over, in mere regard to a writer who hath copied even the manners of *Philalethes*, and whom in answering the other I have, if I am not much mistaken, sufficiently answered.

2. Mr. Walton touches on the same points that the other had touched upon before him. He pursues a hint which the other had given[3] about Sir Isaac's first section concerning the *rationes primæ et ultimæ*. He discreetly avoids, like the other, to say one syllable of second, third, or fourth fluxions, and of divers other points mentioned

[1] A *Vindication of Sir Isaac Newton's Principles of Fluxions*, by J. Walton of Dublin, was published in Dublin and London, early in 1735, in which the argument of the *Analyst* is criticised. This *Appendix* is a reply to Walton, added in a second issue of the *Defence*. I regret that I have not found any record of him.

[2] Dr. Jurin.

[3] [*Philalethes*, p. 32.]—AUTHOR.

in the *Analyst*, about all which I observe in him a most prudent and profound silence. And yet he very modestly gives his reader to understand that he is able to clear up all difficulties and objections that have ever been made (p. 5). Mr. Walton, in the beginning, like *Philalethes*, from a particular case makes a general inference; supposing that Infidelity to be imputed to mathematicians in general which I suppose only in the person to whom the *Analyst* was addressed, and certain other persons of the same mind with him. Whether this extraordinary way of reasoning be the cause or effect of his passion, I know not: but before I had got to the end of his *Vindication*, I ceased to be surprised at his logic and his temper in the beginning. The double error, which in the *Analyst* was plainly meant to belong to others, he with *Philalethes* (whose very oversight he adopts) supposeth to have been ascribed to Sir Isaac Newton (p. 36). And this writer also, as well as the *Cantabrigian*, must needs take upon him to explain the motive of my writing against fluxions; which he gives out, with great assurance, to have been because Sir Isaac Newton had presumed to interpose in prophecies and revelations, and to decide in religious affairs (p. 4); which is so far from being true that, on the contrary, I have a high value for those learned remains of that great man, whose original and free genius is an eternal reproach to that tribe of followers who are always imitating but never resemble him. This specimen of Mr. Walton's truth will be a warning to the reader to use his own eyes, and in obscure points never to trust the gentleman's candour, who dares to misrepresent the plainest.

3. I was thinking to have said no more concerning this author's performance, but, lest he should imagine himself too much neglected, I entreat the reader to have the patience to peruse it; and if he finds any one point of the doctrine of fluxions cleared up, or any one objection in the *Analyst* answered, or so much as fairly stated, let him then make his compliments to the author. But, if he can no more make sense of what this gentleman has written than I can, he will need no answer to it. Nothing is easier than for a man to translate, or copy, or compose a plausible discourse of some pages in technical terms,

whereby he shall make a shew of saying somewhat, although neither the reader nor himself understand one tittle of it. Whether this be the case of Mr. Walton, and whether he understands either Sir Isaac Newton, or me, or himself (whatever I may think), I shall not take upon me to say. But one thing I know, that many an unmeaning speech passeth for significant by the mere assurance of the speaker, till he cometh to be catechised upon it; and then the truth sheweth itself. This Vindicator, indeed, by his dissembling nine parts in ten of the difficulties proposed in the *Analyst*, sheweth no inclination to be catechised by me. But his scholars have a right to be informed. I therefore recommend it to them not to be imposed on by hard words and magisterial assertions, but carefully to pry into his sense, and sift his meaning, and particularly to insist on a distinct answer to the following Questions.

4. Let them ask him—Whether he can conceive velocity without motion, or motion without extension, or extension without magnitude? If he answers that he can, let him teach them to do the same. If he cannot, let him be asked, how he reconciles the idea of a fluxion which he gives (p. 13) with common sense?—Again, let him be asked, Whether nothing be not the product of nothing multiplied by something; and, if so, when the difference between the gnomen and the sum of the rectangles[1] vanisheth, whether the rectangles themselves do not also vanish? i. e. when ab is nothing, whether $Ab+Ba$ be not also nothing? i. e. whether the momentum of AB be not nothing?—Let him then be asked, what his momentums are good for, when they are thus brought to nothing?—Again, I wish he were asked to explain the difference between a magnitude infinitely small and a magnitude infinitely diminished. If he saith, there is no difference, then let him be farther asked, how he dares to explain the method of fluxions, by the *ratio* of magnitudes infinitely diminished (p. 9), when Sir Isaac Newton hath expressly excluded all consideration of quantities infinitely small[2]? If

[1] [See *Vindication*, p. 17.]—AUTHOR.
[2] [See his Introduction to the Quadratures.]—AUTHOR.

this able vindicator should say that quantities infinitely diminished are nothing at all, and consequently that, according to him, the first and last *ratios* are proportions between nothings; let him be desired to make sense of this, or explain what he means by 'proportion between nothings.' If he should say, the ultimate proportions are the *ratios* of mere limits, then let him be asked how the limits of lines can be proportioned or divided?—After all, who knows but this gentleman, who hath already complained of me for an uncommon way of treating mathematics and mathematicians (p. 5), may (as well as the *Cantabrigian*) cry out 'Spain and the inquisition!' when he finds himself thus closely pursued and beset with interrogatories? That we may not, therefore, seem too hard on an innocent man, who probably meant nothing, but was betrayed by following another into difficulties and straits that he was not aware of, I shall propose one single expedient, by which his disciples (whom it most concerns) may soon satisfy themselves whether this Vindicator really understands what he takes upon him to vindicate. It is, in short, that they would ask him to explain the second, third, or fourth fluxions upon his principles. Be this the touchstone of his *Vindication*. If he can do it, I shall own myself much mistaken: if he cannot, it will be evident that he was much mistaken in himself, when he presumed to defend fluxions without so much as knowing what they are. So, having put the merits of the cause on this issue, I leave him to be tried by his scholars.

REASONS

FOR NOT REPLYING TO

MR. WALTON'S FULL ANSWER

IN A

LETTER TO P. T. P.

BY THE AUTHOR OF

The Minute Philosopher

Ex Fumo lucem

First published in 1735

REASONS

FOR NOT REPLYING TO

MR. WALTON'S FULL ANSWER[1].

1. THERE are some men that can neither give nor take an answer, but, writing merely for the sake of writing, multiply words to no purpose. There are also certain careless writers that, in defiance of common sense, publish such things as, though they are not ashamed to utter, yet, other men may well be ashamed to answer. Whether there be anything in Mr. Walton's method of vindicating Fluxions, that might justify my taking no farther notice of him, on the above-mentioned considerations, I leave you and every other reader to judge. But those, Sir, are not the reasons I shall assign for not replying to Mr. Walton's 'full answer.' The true reason is, that he seems at bottom a facetious man, who, under the colour of an opponent, writes on my side of the question, and really believes no more than I do of Sir Isaac Newton's doctrine about fluxions, which he exposes, contradicts, and confutes, with great skill and humour, under the mask of a grave vindication.

2. At first I considered him in another light, as one who had good reason for keeping to the beaten track, who

[1] In 1735 Walton resumed the controversy, in his *Catechism of the Author of the Minute Philosopher fully considered*, which appeared at Dublin in that year, 'printed by M. Rhames, for R. Gunne, bookseller in Capel Street.' Berkeley retorted with vigour in this tract. A second edition of Walton's *Catechism* contains an *Appendix* in answer to Berkeley's *Reasons*, to which Berkeley made no reply. This tract is his last in the controversy occasioned by the *Analyst*, which thereupon became exclusively mathematical and so more remote from the metaphysical foundations alike of mathematics and religion, in which Berkeley was chiefly interested.

had been used to dictate, who had terms of art at will, but was indeed at small trouble about putting them together, and perfectly easy about his readers understanding them. It must be owned, in an age of so much ludicrous humour, it is not every one can at first sight discern a writer's real design. But, be a man's assertions ever so strong in favour of a doctrine, yet if his reasonings are directly levelled against it, whatever question there may be about the matter in dispute, there can be none about the intention of the writer. Should a person, so knowing and discreet as Mr. Walton, thwart and contradict Sir Isaac Newton, under pretence of defending his fluxions, and should he at every turn say such uncouth things of these same fluxions, and place them in such odd lights as must set all men in their wits against them, could I hope for a better second in this cause? Or could there remain any doubt of his being a disguised Free-thinker in mathematics, who defended fluxions just as a certain Free-thinker in religion did the rights of the Christian church[1]?

3. Mr. Walton indeed after his free manner calls my *Analyst* a libel[2]. But this ingenious gentleman well knows a bad vindication is the bitterest libel. Had you a mind, Sir, to betray and ridicule any cause under the notion of vindicating it, would you not think it the right way to be very strong and dogmatical in the affirmative, and very weak and puzzled in the argumentative parts of your performance? To utter contradictions and paradoxes without remorse, and to be at no pains about reconciling or explaining them? And with great good-humour, to be at perpetual variance with yourself and the author you pretend to vindicate? How successfully Mr. Walton hath practised these arts, and how much to the honour of the great client he would seem to take under his protection, I shall particularly examine throughout every article of his full answer.

4. First, then, saith Mr. Walton, 'I am to be asked, whether I can conceive velocity without motion, or motion without extension, or extension without magnitude?' To which he answereth in positive terms, that he can conceive

[1] The reference is to Tindal's *Rights of the Christian Church.*

[2] [*Vindication*, p. 1.]—AUTHOR.

velocity and motion in a point (p. 7). And to make out this he undertakes to demonstrate, 'that if a thing be moved by an agent operating continually by the same force, the velocity will not be the same in any two different points of the described space; but that it must vary upon the least change of space.'—Now, admitting thus much to be demonstrated, yet I am still at a loss to conceive how Mr. Walton's conclusion will follow, to wit, 'that I am greatly mistaken in imagining there can be no motion, no velocity, in a point of space' (p. 10). Pray, Sir, consider his reasoning. The same velocity cannot be in two points of space; therefore velocity can be in a point of space. Would it not be just as good reasoning to say, the same man cannot be in two nutshells; therefore a man can be in a nutshell? Again, velocity must vary upon the least change of space; therefore there may be velocity without space. Make sense of this if you can. What have these consequences to do with their premises? Who but Mr. Walton could have inferred them? Or how could even he have inferred them had it not been in jest?

5. Suppose the centre of a falling body to describe a line; divide the time of its fall into equal parts, for instance, into minutes. The spaces described in those equal parts of time will be unequal. That is, from whatsoever points of the described line you measure a minute's descent, you will still find it a different space. This is true. But how or why from this plain truth a man should infer, that motion can be conceived in a point, is to me as obscure as any the most obscure mysteries that occur in this profound author. Let the reader make the best of it. For my part, I can as easily conceive Mr. Walton should walk without stirring, as I can his idea of motion without space. After all, the question was not whether motion could be proved to exist in a point, but only whether it could be conceived in a point. For, as to the proof of things impossible, some men have a way of proving that may equally prove anything. But I much question whether any reader of common sense will undertake to conceive what this pleasant man at inference undertakes to prove.

6. If Mr. Walton really meant to defend the author of the fluxionary method, would he not have done it in a

way consistent with this illustrious author's own principles? Let us now see what may be Sir Isaac's notion about this matter. He distinguisheth two sorts of motion, absolute and relative. The former he defineth to be a translation from absolute place to absolute place, the latter from one relative place to another[1]. Mr. Walton's is plainly neither of these sorts of motion. But some third kind, which what it is, I am at a loss to comprehend. But I can clearly comprehend that, if we admit motion without space, then Sir Isaac Newton's account of it must be wrong: for place by which he defines motion is, according to him, a part of space. And if so, then this notable defender hath cut out new work for himself to defend and explain. But about this, if I mistake not, he will be very easy. For, as I said before, he seems at bottom a back friend to that great man; which opinion you will see farther confirmed in the sequel.

7. I shall no more ask Mr. Walton to explain anything: for I can honestly say, the more he explains, the more I am puzzled. But I will ask his readers to explain, by what art a man may conceive motion without space. And, supposing this to be done, in the second place to explain, how it consists with Sir Isaac Newton's account of motion. Is it not evident that Mr. Walton hath deserted from his old master, and been at some pains to expose him, while he defends one part of his principles by overturning another? Let any reader tell me, what Mr. Walton means by motion, or, if he can guess, what this third kind is, which is neither absolute nor relative, which exists in a point, which may be conceived without space. This learned professor saith, 'I have no clear conception of the principles of motion' (p. 24). And in another place (p. 7) he saith, 'I might have conceived velocity in a point, if I had understood and considered the nature of motion.' I believe I am not alone in not understanding his principles. For myself, I freely confess the case to be desperate. I neither understand them, nor have any hopes of ever being able to understand them.

8. Being now satisfied that Mr. Walton's aim is not to clear up or defend Sir Isaac's principles, but rather to

[1] [See Schol. def. VIII. *Philos. Nat. Princip. Math.*]—AUTHOR.

contradict and expose them, you will not, I suppose, think it strange, if—instead of putting questions to this intrepid answerer, who is never at a loss, how often soever his readers may—I entreat you, or any other man of plain sense, to read the following passage, cited from the thirty-first section of the *Analyst*, and then try to apply Mr. Walton's answer to it: whereby you will clearly perceive what a vein of raillery that gentleman is master of. 'Velocity necessarily implies both time and space, and cannot be conceived without them. And if the velocities of nascent or evanescent quantities, i.e. abstracted from time and space, may not be comprehended, how can we comprehend and demonstrate their proportions? Or consider their *rationes primæ et ultimæ*. For, to consider the proportion or ratio of things implieth that such things have magnitude: that such their magnitudes may be measured, and their relations to each other known. But, as there is no measure of velocity except time and space, the proportion of velocities being only compounded of the direct proportion of the spaces and the reciprocal proportion of the times; doth it not follow, that to talk of investigating, obtaining, and considering the proportions of velocities, exclusively of time and space, is to talk unintelligibly?' Apply now, as I said, Mr. Walton's full answer, and you will soon find how fully you are enlightened about the nature of fluxions.

9. In the following article of Mr. Walton's full answer, he saith divers curious things, which being derived from this same principle—that motion may be conceived in a point—are altogether as incomprehensible as the origin from whence they flow. It is obvious and natural to suppose Ab and Ba[1] to be rectangles produced from finite lines multiplied by increments. Mr. Walton indeed supposeth that when the increments vanish or become nothing the velocities remain, which being multiplied by finite lines produce those rectangles (p. 13). But, admitting the velocities to remain, yet how can any one conceive a rectangular surface to be produced from a line multiplied by velocity, otherwise than by supposing such line multiplied by a line or increment which shall be exponent of

[1] [See *Nat. Phil. Princip. Math.* l. II. lem. 2.]—AUTHOR.

or proportional to such velocity? You may try to conceive it otherwise. I must own I cannot. Is not the increment of a rectangle itself a rectangle? must not then Ab and Ba be rectangles? and must not the coefficients or sides of rectangles be lines? Consequently are not b and a lines, or (which is the same thing) increments of lines? These increments may indeed be considered as proportional to and exponents of velocity. But exclusive of such exponents to talk of rectangles under lines and velocities is, I conceive, to talk unintelligibly. And yet this is what Mr. Walton doth, when he maketh b and a in the rectangles Ab and Ba to denote mere velocities.

10. As to the question, whether nothing be not the product of nothing multiplied by something, Mr. Walton is pleased to answer in the affirmative. And nevertheless, when ab is nothing, that is, when a and b are nothing, he denies that $Ab+Ba$ is nothing. This is one of those many inconsistencies which I leave the reader to reconcile. But, saith Mr. Walton, the sides of the given rectangle still remain, which two sides according to him must form the increment of the flowing rectangle. But in this he directly contradicts Sir Isaac Newton, who asserts that $Ab+Ba$ and not $A+B$ is the increment of the rectangle $A.B$. And, indeed, how is it possible a line should be the increment of a surface? *Laterum incrementis totis a et b generatur rectanguli incrementum* $Ab+Ba$, are the words of Sir Isaac[1], which words seem utterly inconsistent with Mr. Walton's doctrine. But no wonder that gentleman should not agree with Sir Isaac, since he cannot agree even with himself; but contradicts what he saith elsewhere, as the reader may see, even before he gets to the end of that same section, wherein he hath told us, that 'the gnomon and the sum of the two rectangles are turned into those two sides by a retroverted motion' (pp. 11 and 12). Which proposition, if you or any other person should try to make sense of, you may possibly be convinced that this profound author is as much at variance with common sense as he is with himself and Sir Isaac Newton.

11. Mr. Walton, in the ninth page of his *Vindication*, in

[1] [See *Nat. Phil. Princip. Math.* l. II. lem. 2.]—AUTHOR.

order to explain the nature of fluxions, saith that 'to obtain the last ratio of synchronal increments, the magnitude of those increments must be infinitely diminished.' Notwithstanding which, in the twenty-third page of his full answer, he chargeth me as greatly mistaken, in supposing that he explained the doctrine of fluxions by the ratio of magnitudes infinitely diminished. It is an easy matter for any author to write so as to betray his readers into mistakes about his meaning. But then it is not easy to conceive what right he hath to upbraid them with such their mistakes. If I have mistaken his sense, let any one judge if he did not fairly lead me into the mistake. When a man puzzleth his reader, saith and unsaith, useth ambiguous terms and obscure terms, and putteth them together in so perverse a manner that it is odds you can make out no sense at all, or, if any, wrong sense; pray who is in fault but the writer himself? Let any one consider Mr. Walton's own words, and then say whether I am not justified in making this remark.

12. In the twentieth page of his full answer, Mr. Walton tells us that 'fluxions are measured by the first or last proportions of isochronal increments generated or destroyed by motion.' A little after he saith, these ratios subsist when the isochronal increments have no magnitude. Now, I would fain know whether the isochronal increments themselves subsist when they have no magnitude? Whether by isochronal increments we are not to understand increments generated in equal times? Whether there can be an increment where there is no increase, or increase where there is no magnitude? Whether if magnitudes are not generated in those equal times, what else is generated therein, or what else is it that Mr. Walton calls isochronal? I ask the reader these questions. I dare not ask Mr. Walton. For, as I hinted before, the subject grows still more obscure in proportion as this able writer attempts to illustrate it.

13. We are told (p. 22) 'that the first or last ratio of the isochronal spaces hath a real existence, forasmuch as it is equal to the ratio of the two motions of two points; which motions, subsisting when the isochronal spaces are nothing, preserve the existence of the first or last ratio of these spaces, or keep it from being a ratio of nothings.' In

order to assist your understanding, it must not be omitted that the said two points are supposed to exist at the same time in one point, and to be moved different ways without stirring from that point. Mr. Walton hath the conscience to call this riddle a full and clear answer: to make sense of which you must suppose it one of his ironies. In the next and last article of his performance, you still find him proceed in the same vein of raillery upon fluxions.

14. It will be allowed that whoever seriously undertook to explain the second, third, and fourth fluxions of Sir Isaac Newton would have done it in a way agreeable to that great man's own doctrine. What Sir Isaac's precise notion is I will not pretend to say. And yet I will venture to say, it is something that cannot be explained by the three dimensions of a cube. I frankly own, I do not understand Sir Isaac's doctrine so far as to frame a positive idea of his fluxions. I have, nevertheless, a negative conception thereof, so far as to see that Mr. Walton is in jest, or (if in earnest) that he understands it no more than I do.

15. Sir Isaac tells us that he considers indeterminate quantities as flowing, or in other words, as increasing or decreasing by a perpetual motion. Which quantities he denotes by the latter letters of the alphabet, and their fluxions or celerities of increasing by the same letters pointed over head, and the fluxions of fluxions or second fluxions, i. e. the mutations more or less swift of the first celerities, by the same letters pointed with double points; and the mutations of those mutations of the first mutations or fluxions or celerities of increasing, which he calls fluxions of fluxions of fluxions, or third fluxions, by three points; the fourth fluxions by four points; the fifth by five; and so on[1]. Sir Isaac, you see, speaks of quantity in general. And in the *Analyst* the doctrine is exemplified and the case is put in lines. Now in lines, where there is only one dimension, how are we enabled to conceive second, third, or fourth fluxions, by conceiving the generation of three dimensions in a cube? Let any one but read what Sir Isaac Newton or what I have said, and then apply what Mr. Walton hath written about the

[1] [See his Treatise *De Quadratura Curvarum.*]—AUTHOR.

three dimensions of a cube, and see whether the difficulties are solved, or the doctrine made one whit the clearer by this explication.

16. That you may the better judge of the merit of this part of Mr. Walton's performance, I shall beg leave to set down a passage or two from the *Analyst*. 'As it is impossible to conceive velocity without time or space, without either finite length or finite duration, it must seem above the power of man to comprehend even the first fluxions. And if the first are incomprehensible, what shall we say of the second and third fluxions, &c.? He who can conceive the beginning of a beginning, or the end of an end, somewhat before the first or after the last, may perhaps be sharp-sighted enough to conceive these things. But most men, I believe, will find it impossible to understand them in any sense whatsoever. One would think that men could not speak too exactly on so nice a subject. And yet we may often observe that the exponents of fluxions, or notes representing fluxions are confounded with the fluxions themselves. Is not this the case when, just after the fluxions of flowing quantities were said to be the celerities of their increasing, and the second fluxions to be the mutations of the first fluxions or celerities, we are told that $\dddot{z}. \ddot{z}. \dot{z}. z. \dot{z}. \ddot{z}. \dddot{z}.$ represents a series of quantities, whereof each subsequent quantity is the fluxion of the preceding; and each foregoing is a fluent quantity having the following one for its fluxion? Divers series of quantities and expressions, geometrical and algebraical, may be easily conceived, in lines, in surfaces, in species, to be continued without end or limit. But it will not be found so easy to conceive a series, either of mere velocities or of mere nascent increments, distinct therefrom and corresponding thereunto[1].' Compare what is here said with Mr. Walton's genesis of a cube, and you will then clearly see how far this answerer is from explaining the nature of second, third, and fourth fluxions: and how justly I might repay that gentleman in kind, and tell him in his own language, that 'all his skill is vain and impertinent.' (*Vind.* p. 36.)

17. But it doth not become me to find fault with this

[1] [*Analyst*, sect. 44-46.]—AUTHOR.

learned professor, who at bottom militates on my side, and in this very section makes it his business directly to overthrow Sir Isaac Newton's doctrine. For he saith in plain terms that there can be no fourth fluxion of a cube (p. 25), that is, there can be no second fluxion of a line, and *à fortiori*, no third, fourth, fifth, &c. Insomuch that, with one single dash of his pen, Mr. Walton destroys, to the great relief of the learned world, an indefinite rank of fluxions of different orders that might have reached from pole to pole. I had distinctly pointed out the difficulties, in several parts both of my *Analyst* and *Defence*, and I leave you to judge whether he explains, or even attempts to explain, one of them. Instead thereof he tells us of the trine dimension of a cube generated by motion: whence he takes occasion, as hath been observed, to explode Sir Isaac's own doctrine, which is utterly inconsistent with Mr. Walton's. And can you now doubt the real design of this egregious vindicator?

18. Before ever Sir Isaac Newton thought of his fluxions, everybody knew there were three dimensions in a cube, and that a solid might be generated by the motion of a surface, a surface by the motion of a line, and a line by the motion of a point. And this in effect is all we know from Mr. Walton's explication. As for his dwelling so minutely on the genesis of the solid parts of a cube, a thing so foreign from the purpose, the only rational account I can give of it is that Mr. Walton, by puzzling the imagination of his vulgar readers, hoped the better to disguise his betraying the doctrine of his great client, which to a discerning eye he manifestly gives up; and instead thereof humorously substitutes what all the world knew before Sir Isaac was born, to wit, the three dimensions of a cube and the genesis thereof by motion.

19. Upon the whole, I appeal to you and every intelligent reader, whether this thing, which Mr. Walton is pleased ironically to call a 'full answer,' doth not carry throughout a sly insinuation that the profound science of fluxions cannot be maintained but by the help of most unintelligible paradoxes and inconsistencies? So far, indeed, as affirmations go, he sheweth himself an able support of Sir Isaac Newton. But then in his reasonings he drops that great

man upon the most important points, to wit, his doctrine of motion and his doctrine of fluxions; not regarding how far the demonstration of his famous *Principia* is interested therein. To convince you still more and more of the truth hereof, do but reflect a little on Mr. Walton's conduct. Can you think it probable that so learned and clear-headed a writer would have laid down such a direct repugnancy to common sense, as his idea of motion in a point, for the groundwork of his explanation, had it been his real intention to explain? Or, can you suppose he would have been absolutely silent on so many points urged home both in the *Analyst* and *Defence*, which it concerned a vindicator of Sir Isaac not to have overlooked? Can you imagine that if he meant seriously to defend the doctrine of fluxions, he would have contented himself with barely asserting that 'Sir Isaac Newton in the introduction to his Quadrature of Curves, in the second lemma of the second book, and in the scholium to the first section of the first book of his Principles of Philosophy, hath delivered his doctrine of fluxions in so clear and distinct a manner, without the least inconsistency in terms or arguments, that one would have thought it impossible for any person not to have understood him?' (p. 30.)

20. Is it possible, I say, that Mr. Walton could in earnest hope we should take his bare word, as so much more credible than Sir Isaac's, and not rather have endeavoured to answer the questions, and reconcile the difficulties set forth in my *Defence of Free-thinking*; for instance, in sect. 36? Wherein I entreat my antagonist to explain 'whether Sir Isaac's momentum be a finite quantity, or an infinitesimal, or a mere limit,' adding, 'If you say a finite quantity, be pleased to reconcile this with what he saith in the scholium of the second lemma of the first section of the first book of his Principles—*Cave intelligas quantitates magnitudine determinatas, sed cogita semper diminuendas sine limite.* If you say, an infinitesimal: reconcile this with what is said in his introduction to the Quadratures—*Volui ostendere quod in methodo fluxionum non opus sit figuras infinite parvas in geometriam inducere.* If you should say, it is a mere limit, be pleased to reconcile this with what we find in the first case of the

second lemma in the second book of his Principles—*Ubi de lateribus A et B deerant momentorum dimidia, &c., where the moments are supposed to be divided.*'—I shall scarce think it worth my while to bestow a serious thought on any writer who shall pretend to maintain Sir Isaac's doctrine, and yet leave this passage without a reply. And the reader, I believe, will think with me that, in answer to difficulties distinctly proposed and insisted on, to offer nothing but a magisterial assertion is a mere grimace of one who made merry with fluxions, under the notion of defending them. And he will be farther confirmed in this way of thinking, when he observes that Mr. Walton hath not said one syllable in reply to those several sections of my *Defence* which I had particularly referred to, as containing a full answer to his *Vindication.* But it is no wonder if, with Sir Isaac's doctrine, he should drop also his own arguments in favour thereof.

21. I have been at the pains once for all to write this short comment on Mr. Walton, as the only way I could think of for making him intelligible, which will also serve as a key to his future writings on this subject. And I was the rather inclined to take this trouble, because it seemeth to me there is no part of learning that wants to be cleared up more than this same doctrine of fluxions, which hath hitherto walked about in a mist to the stupefaction of the literati of the present age. To conclude, I accept this professor's recantation; nor am at all displeased at the ingenious method he takes to disguise it. Some zealous fluxionists may perhaps answer him.

[[1]SIRIS

A CHAIN OF]

PHILOSOPHICAL REFLEXIONS AND INQUIRIES

CONCERNING

THE VIRTUES OF TAR-WATER

AND DIVERS OTHER SUBJECTS CONNECTED TOGETHER

AND ARISING ONE FROM ANOTHER

As we have opportunity, let us do good unto all men.—GAL. vi. 10.
Hoc opus, hoc studium, parvi properemus et ampli.—HOR.

First published in 1744

[1] The words within brackets were added in the second edition.

EDITOR'S PREFACE TO SIRIS

SIRIS—Berkeley's 'Chain of philosophical reflexions and inquiries'—presents his metaphysical philosophy in its latest form, as it was when he was about sixty years of age. More than thirty years had then elapsed since he had evolved the meaning of the words Reality and Externality, in the *Principles of Human Knowledge*; and more than twenty since he had unfolded, in the *De Motu*, thoughts about Causation, which suggest the Chain that here connects the supposed medicinal virtues of Tar-water with Omnipotent Intelligence immanent in the universe. In the interval, more than ten years before the date of *Siris*, he had defended his early philosophy, in defending his theory of Vision; and he had in *Alciphron* applied the same philosophy in vindication of Christian theism. Now, in 1744, his philosophy, developed and enriched by much reading and meditation, is made to crown a philanthropic treatise in medical metaphysics. It was printed in Dublin, and reprinted in London, 'for W. Innys and C. Hitch, in Paternoster Row, and C. Davis in Holbourn. Price two shillings.'

Siris, regarded as a philosophical essay, is the consummation, on the basis of Ancient Philosophy, of Berkeley's conception of the concrete universe, past, present, and future, as in necessary dependence upon all-constitutive Intelligence. Its 'chain of philosophical reflexions and inquiries' is the most curious and profound of Berkeley's

works. The scanty metaphysical literature of these islands in the last century contains no other book so remarkable; although it has been overlooked even by those learned in the history and bibliography of philosophy. Every time we open its pages we find fresh seeds of thought. There is the unexpectedness of genius in its whole movement. It breathes the spirit of Plato and the Neoplatonists in the least Platonic generation of English history since the revival of letters, and it extracts this Platonic spirit from a thing of sense so commonplace as tar. It connects tar with the highest thoughts about things, by links which involve botanical, chemical, physiological, and metaphysical speculations that are subtle and mystical. Its immediate aim is to confirm the benevolent conjecture, that tar may be made to yield a 'water of health,' fitted to remove, or at least mitigate, all the diseases of the human organism in this mortal state, and to carry fresh supplies of the very essence of life into the whole animal creation. Its successive links of ascending science are connected, by a gradual evolution, first, with ancient and modern literature concerning Fire; and, next, with the meditations of the greatest of the ancients, about the substantial and causal dependence of the universe upon active Mind. In one view *Siris* may be looked at as a classic Commonplace Book, into which the fruits of the learned meditation of Berkeley's life, regarding the universe in which we find ourselves, and the universal omnipresent Power, were gathered, and in which, with eloquent reiteration, they are expressed in a contemplative rather than in an argumentative form. It is a chain of aphorisms, in which the connexion is produced by quaint and subtle associations. Speculations of thinkers, ancient and modern, blend themselves with the links, and the whole forms a series of studies, as well in science of nature as in Greek and Eastern theosophy and metaphysics.

When we pass into *Siris* from the book of *Principles*, in which, more than thirty years before, Berkeley had reasoned out, with an enthusiasm more subdued in his advanced age, his new conception of external nature, we are transported from Locke to Plato, and find revived the ancient conception of gradation in existence, and of the constant animation of the universe. We exchange the young Dublin enthusiast, joyfully awakened to a great discovery, which was for ever to dispel empty abstractions in the light of concrete realities, for the companion of ancient sages, who had been taught by experience that one 'who would make a real progress in knowledge, must dedicate his age as well as youth, the later growth as well as the first fruits, at the altar of truth;' and who had gradually learned that 'through the dusk of our gross atmosphere,' in this life of sense, 'the sharpest eye cannot see clearly.'

This modification of philosophic thought and tone, as well as the singular occasion of its manifestation in a medical tract on tar-water, are explained when we review the circumstances in which *Siris* was composed. During the sixteen years which preceded its publication, Berkeley had lived much alone, among his books, first in Rhode Island, and afterwards in his secluded diocese of Cloyne; for the most part in indifferent health. Books, especially Plato and the Neoplatonists, became his favourite companions; while out of doors, among the poor of his diocese, he was, in the early years of his residence, as we gather from his correspondence, surrounded in an unusual degree by suffering and disease. We find him in every period of his life fond of natural science, and apt to yield to uncommon trains of thought which physical facts were apt to raise in his mind. In his 'remote corner' at Cloyne, the sufferings of his neighbours suggested the remedy of tar-water, of which he had heard much in Rhode Island, and which, when tried in different diseases, seemed to

grow under his hand into a Universal Medicine. 'I do not,' he modestly conjectures[1], 'I do not say that it is a Panacea; I only suspect it to be so: time and trial will shew.'

The mere suspicion of a discovery so wonderful, sustained by alleged facts and by ingenious speculation in the 119 opening sections of *Siris*, was enough to set Berkeley's thoughts a-going about the Ultimate Cause of tar-water being a cure for all corporeal ills in this prison of the body. Tar, to begin with, is drawn from the vegetable world, in modes which he describes (sect. 10–28). This leads to an inquiry into Vegetable Life; especially in organisms, such as pines, from which tar is readily produced (sect. 29–38). So we are, in the opening part of *Siris*, conducted through regions of vegetable physiology and botany, in company with Theophrastus and Pliny, Jonstonus, John Evelyn, and that 'curious anatomist of plants,' Dr. Nehemiah Grew. Firs and pines, we are told, secrete an alimentary juice, which consists of oily, aqueous, and saline particles. This, 'by the economy of the plant, and the action of the sun, is strained and concocted into an inspissated oil or balsam'; this oil being in those trees unusually abundant; also tenacious of 'acid spirit or vegetable soul': therefore when exalted and enriched by the solar action, it is found to be charged with 'a most noble medicine, the last and best product of a tree perfectly maturated by time and sun' (sect. 38). Cures, in an immense variety of diseases, are accordingly attributed to this acid, when it has been drawn from tar by the menstruum of water (sect. 2–7, 60–119).

Meditation upon the 'acid spirit or vegetable soul,' 'sheathed in its thin volatile oil,' and readily withdrawn from tar by water, opens the way to more general questions about acids and volatile salts. We are thus carried on

(sect. 120) to chemical phenomena and their laws, and are led in the following sections to speculate in Chemistry. Appeals are made to Newton, Boerhaave, Homberg, and Boyle, the chief authorities on acids, alkalis, and salts (sect. 126–136). Some curious, old-fashioned chemistry, derived from Homberg, is served up in this part of *Siris*.

As 'the acid spirit or salt, that mighty instrument in the hand of nature,' is supposed to reside in Air, and to be diffused through that element, the train of thought is next directed to the atmosphere (sect. 137–151)—'the receptacle as well as source of all sublunary forms'—'the common seminary of all vivifying principles.' Air is assumed, according to an ancient opinion, to be 'a collection or treasury of active principles, through which a latent vivifying spirit is diffused'; the unique ingredient on which life immediately depends. Its heterogeneous elements are, it is alleged, united under a subtle sort of Fire, Light, or Æther, the Vital Spirit of the Universe, with which the Acid extracted by water from tar is charged.

We pass, accordingly (sect. 152) from crude chemistry of Air to physical and metaphysical speculation about this invisible Fire; the vital spirit of the sensible world; the principle which corresponds in Nature, the *Macrocosm*, to the animal spirit in Man, the *microcosm* (sect. 152–165). The ancient biological conception of the universe, with its universal soul (*anima mundi*), is accommodated to this fire-philosophy, and contrasted with the lifeless, mechanical science against which Berkeley everywhere protests. His curious learning is employed (sect. 166–205) in defending a science of Vitalized Fire. Some of the highest authorities are adduced: Heraclitus (its chief source in Greece), Plato, the Peripatetics, Theophrastus, the Stoics, Plotinus, the Hermic writers, and Hippocrates, not to speak of the Eastern philosophers, among the ancients; Newton, Homberg, Boerhaave, Hales, Nieuwentyt, and Willis, among moderns. Berkeley tells

elsewhere[1] that he had 'for a long time entertained the opinion, agreeable to many ancient philosophers—that Fire may be regarded as the Animal Spirit of this visible world.' When he came to entertain this opinion he does not say. It is in *Siris* that it first distinctly appears. Vital Fire is there the ultimate link in the physical chain by which changes in nature are concatenated.

This Vital Fire is physical, not metaphysical (sect. 206–213); although it is all-pervading, and governed by wonderful laws, assigned to it by ancient and modern authorities. In various modes and degrees, it is diffused through plants; and, especially after 'lodgment in the native balsam of pines and firs,' it finds its way benignly and beneficially into the human organism, so as to 'warm without heating, to cheer but not inebriate' (sect. 217). We are warned that Newton's elastic Æther is not to be confounded with this invisible animated Fire; nor is it subject to those laws of attraction and repulsion which play the governing part in Newtonian physics (sect. 221–230).

Thus far Berkeley's Chain is physical. But a chain that is *only* physical cannot support itself. It is no final explanation of natural changes, whether mechanical, chemical, or vital. All sensible phenomena, with their *natural causes*, which are only *natural signs*, presuppose the perpetual operation of Active Reason (sect. 231–238; see also sect. 153, 155, 160, 161). Philosophy proper must be spiritual, not mechanical; the facts and laws of physical science are but the sensible expression of Divine Agency (sect. 251–264). Active Intelligence is the only summary explanation of the universe. In Active Reason alone is found the 'golden chain' of intelligible reality.

The last hundred sections of *Siris* accumulate authorities

[1] See *First Letter to Thomas Prior, on the Virtues of Tar-water.* Sect. 16.

on behalf of this spiritual philosophy, which, in its eccentric transformations, here appears reflected through the greatest minds of the ancient world. Those sections connect, by suggestion, early with recent speculation—the anticipations of Pythagoras, Parmenides, Plato, and Plotinus with developments in the German thought of Leibniz, and, after Berkeley, in Schelling and Hegel. This portion of *Siris* is probably the nearest approach in English philosophy of the eighteenth century to German constructive Idealism of the nineteenth. In each section gold may be found.

Perceived Space and absolute Space—blind Fate and spiritual Fate—*Anima Mundi*—Pantheism and Atheism—the antithesis and synthesis of Sense and Intelligence—the actual and the potential existence of Matter—Deity—the origin and various phases of theistic conception—divine and human Personality—the Divine Ideas of Platonism—the Divine Trinity of Personality, Reason, and Life—are all pondered in succession; along with the reported thought, on those deep themes, of Pythagoras, Plato, Aristotle, Theophrastus, Plotinus, Jamblicus, Proclus, Themistius, Simplicius, and the Hermic writers.

Berkeley discerns outlines of his own spiritual conception of nature in the dim intuitions of Greek and Egyptian philosophy (sect. 266–269), with all which he is more in sympathy than with the prevailing mechanical and materialistic science. Ancient notions of Space and Fate seem to him deeper than the modern, and more readily open to a spiritual interpretation (sect. 270–273).

In the modern 'phantom' of uncreated Space, as distinguished from visible and tangible extension—derived neither from sense nor intellect (sect. 271–318), and therefore with Berkeley a phantom negation, the result of λογισμὸς νόθος (sect. 306, 318)—he sees the source of other 'phantoms'—dead Matter, and blind Fate—'children of imagination grafted upon sense' (sect. 292)—with their

sceptical consequences. He even prefers, as more spiritual, the inclination of some early thinkers to represent the universe as an Animal (sect. 273–287); seeing in this at the worst a one-sided expression of immediate and perpetually acting Deity at the heart of all change. *Anima Mundi*, held in various forms in Egypt, Greece, and Alexandria, harmonized with his animating Fire, 'the living, omniform, seminary of the world'; and also with the uniform teaching of his life, as to the dependent reality of Matter, and the need for referring change to the agency of Mind. God is thus (as it were) the Intelligible Soul of the world, by whose perpetual and pervading activity all things are connected in the unity of the Golden Chain; the complicated links of which human science, with weak and faltering hand, tries to display in true scientific order.

So all things finally centre in the unity of Mind, which substantiates all and causes all. This is τὸ Ἕν—the ONE—of Egyptians and Greeks (sect. 287–295); to all created beings the source of unity and identity, of harmony and order, existence and stability. 'It is neither acid nor salt, nor sulphur, nor air, nor æther, nor visible corporeal fire, much less the phantom fate or necessity, that is the real Agent; but, by a certain analysis, a regular connexion and climax, we ascend through all these mediums to a glimpse of the First Mover, invisible, incorporeal, unextended, intellectual source of life and being' (sect. 296).

Thus, by a Chain of innumerable links, we pass from the extreme of Sense, to the extreme of Intelligence; the truths of which last are the really divine science. Accordingly, after great examples among the ancients, ill relished perhaps by modern readers, in an age of 'minute philosophy,' Berkeley 'draws his reader, by insensible transitions, into remote inquiries and speculations, that were perhaps not thought of, either by him or by the author, at first setting out' (sect. 297).

'Theology and Philosophy gently unbind the ligaments that chain the soul down to the earth, and assist her flight toward the sovereign good' (sect. 302). Let us then, Berkeley says in effect, let us rise from our fallen state, by meditating in religious thought upon that contrast yet correlation of Sense and Intelligence, Being and Knowing, the Many and the One, Change and the Eternal, the Individual and the Universal, which lies at the root of whatever is, and which, in these and like modes of conception, has engaged the genuine thinkers in all ages (sect. 301–310). Plato and Aristotle, as he interprets them, did not assign to sensible things an absolute reality, abstracted from percipient Mind. With those ancient sages, unperceived Matter was a dark, indefinable negation, which, with Aristotle, has only potential, not actual existence (sect. 311–319). 'Neither Plato nor Aristotle by Matter understood corporeal substance' as we see it. To them it signified no real, positive being. With the Greeks, Matter was only *pura potentia*, a mere possibility and defect; and, 'since God is absolute perfection and act, it follows that there is the greatest opposition and distance imaginable between God and Matter' (sect. 319).

What then is God? That is the great question which this train of thought suggests. It leads (sect. 320–329) to a restatement of the ultimate conception of Causation which runs through his philosophy. A cause is distinguished from its effects; and the Supreme Power, however involved in the universe in which the Divine Ideas are expressed, is not to be confounded with the universe. The Universal Power is 'a really existing Spirit, transcending all corporeal and sensible things' (sect. 323). A liberal toleration is indeed conceded to the varied language which religious thought employs to express the relation of God to the universe. If we should even say that all concrete things make one God, this would,

he thinks, be an inapt way of expressing a deep truth; but should not be regarded as atheistic, 'so long as Mind or Intellect is admitted to be τὸ ἡγεμονικόν, the governing part' (sect. 288). 'It is nevertheless more respectful, and consequently the truer notion of God, to suppose Him neither made up of parts, nor to be Himself a part of any Whole whatever.' When we find Platonic and Aristotelian philosophers speaking of God as 'mixing with' nature, or 'pervading' nature, he explains this as referring not to mixture in the way of space or extension, but in the way of all-present power, and universal Providence. For *extension* is never applied to mind by Plato and Aristotle; and spiritual things are 'distant from one another' not by *place* but, as Plotinus says, by '*alterity*' (sect. 329).

As a help in the endeavour to rise in contemplation above the selfish feeling and mechanical habit which exclusive study of sensible things is apt to generate, Berkeley, with earnest eloquence, points to the books of ancient philosophers; above all to Plato, 'whose writings are the touchstone of a hasty and shallow mind' (sect. 332). In the remaining aphorisms of *Siris*, he moves in company with him, also with Parmenides, Plotinus, and Proclus, not forgetting the curious Hermic lore which somehow fascinated him in his old age.

In the Ideas of Plato he thinks he finds the beginnings of a reconciliation of philosophy with religion (sect. 335–338). His early sensuous Nominalism is now modified and supplemented by a transcendental Idealism, in which are discerned uncreated necessities of reason that cannot be pictured in sensuous imagination, but by which the evolutions of the world, and the individual mind, should be regulated. This Idealism is dimly present in *Siris*. Here the Ideas are not, like those of Locke, or like the sensuous 'ideas' of the *Principles* and *Dialogues*, 'inert, inactive objects of perception.' They are self-

existent, necessary, uncreated. Nor are they the abstract general ideas against which he had argued long before so emphatically. On the contrary they are 'the most real beings, intellectual and unchangeable; and therefore more real than the fleeting, transient objects of sense; which, *wanting stability*, cannot be objects of science, much less of intellectual knowledge' (sect. 335). 'The most refined human intellect, exerted to its utmost reach, can only seize some imperfect glimpses of the Divine Ideas; abstracted from all things corporeal, sensible, and imaginable. Therefore Pythagoras and Plato treated them in a mysterious manner, concealing rather than exposing them to vulgar eyes; so far were they from thinking that those abstract things, although the most real, were the fittest to influence common minds, or become principles of knowledge, not to say duty and virtue, to the generality of mankind' (sect. 337). 'Nevertheless, as the mind gathers strength by repeated acts, we should not despond, but continue to exert the prime and flower of our faculties, still recovering and reaching on, and struggling into the upper region' (sect. 341).

We are asked to try, in this manner, to rise even above the thought of the Universal Spirit, enlightening and ordering all things; and to enter into the meaning of the ancient tenet of τὸ Ἕν or τὸ Ἀγαθόν, the *fons Deitatis*, by participation in which all exists that exists really, the finite spirits of men included. For Plato thought that in the soul of man, 'prior and superior to intellect, there is Somewhat of a higher nature, by virtue of which we are *One*; and that, by virtue of our *One*, we are most closely joined to Deity' (sect. 345).

What is τὸ Ἕν, thus in a manner common to ourselves, the world, and God? Is it not PERSONALITY? Is not personality the indivisible centre of the human soul, which is a monad so far forth as a person? 'Person is

really that which exists; inasmuch as it alone participates of the divine Unity. Upon mature reflexion the Person or Mind of all created beings seemeth alone indivisible, and to partake most of unity. Sensible things are rather *considered one* (by an act of intelligence) than truly so; they being in a perpetual flux or succession, ever differing and various' (346, 347). Here we find Berkeley's early philosophy—a universe of 'ideas' or 'phænomena,' *realised* in living Persons.

But τὸ Ἕν—the ONE—this abstract personality—seems, as prior to consciousness, to exclude conscious life in God. What is it more than the πρώτη ὕλη of Aristotle?

Berkeley argues (sect. 352) that the ultimate One is necessarily connected with νοῦς or λόγος, as a Second Hypostasis. These two Hypostases are inseparable in Absolute Being or Deity. 'There never was a time supposed wherein τὸ Ἕν subsisted without Intellect (λόγος); the *priority* having been understood as a priority of order or conception, but not a priority of age' (sect. 352). And whoever recognises that the universe is thus grounded in Intellect 'cannot be justly deemed an Atheist.'

Intellect (νοῦς or λόγος), abstracted from Life, is, however, as barren as the One (τὸ Ἕν), abstracted from intellect. Both must participate in Life. Intellect must be living Spirit. Life (ψυχή) is accordingly the Third Hypostasis in the Trinity of the ultimate One. 'Certain it is that the notion of this Trinity is to be found in the writings of many old heathen philosophers; that is to say, a notion of Three Divine Hypostases. Authority, Light, and Life did, to the eye of reason, plainly appear to support, pervade, and animate the mundane system or *Macrocosm*. The same appeared in the *microcosm*; preserving soul and body, enlightening the mind, and moving the affections. And these were conceived to be necessary, universal principles; co-existing and co-operating, in such sort as never to exist

asunder, but on the contrary to constitute One Sovereign of all things. And, indeed, how could Power or Authority avail or subsist without Knowledge? or either without Life and Action?' (sect. 361).

The One must be Thought eternally Living. With this Trinity in the essence of Being *Siris* concludes. Its closing sentences concentrate the protest against selfish and degrading Materialism which eloquently runs through it, and speak in favour of the deeper and therefore truer life that arises amidst the glimpses of the Divine that are open to us, but which our limited and sense-clogged reason can only imperfectly comprehend.

Thus in *Siris* physics continuously pass into metaphysics: the universe is spiritually united in God. Misinterpretation of nature in the physical chain need not intercept the metaphysical or religious light which reveals a divine concatenation of Reason in all things. *Siris*, in this, recalls the *Timæus* of Plato, so often referred to in its aphorisms. Its sense-universe, substantiated in and causally animated by God, of whose Ideas the natural laws of the sensible world are an expression, does not disappear in its errors of therapeutics. Mistaken interpretations of the divine *physical* meaning do not imply that there is no higher divine meaning.

The suggestive title—*Siris*[1] (σειρά, a chain)—was prefixed

[1] '*Seiris*,' De Quincey says, 'ought to have been the name.'

The notion of universal divine concatenation in Nature is one which runs through ancient and modern philosophy, from Homer and Pythagoras, through Plato and Proclus, into Bacon, Leibniz, and Berkeley. It is prominent in the Hermic writings and in Paracelsus, being a favourite with the alchemists.

Some curious gleanings on this subject may be found in *Notes and Queries*, Second Series, vol. III. pp. 63–65, 81–84, 104–107, in an essay on the *Aurea Catena Homeri*, a rare work published in Germany early in the eighteenth century. Its author follows the Egyptians and most ancient sages in regarding Nature as a series of rings or revolving circles, forming a vast Chain, which links God with His humblest creature. The affinity between the Universal Chain and the notions of Paracelsus is

to the second edition, published a few weeks after the first. The first edition appeared in April, 1744, in London, 'printed for C. Hitch, in Pater-noster-row; and C. Davis, against Gray's Inn, Holbourn.'

The medical celebrity of the work was extraordinary for some years after its appearance. Three editions were called for in 1744. Others succeeded in 1746 and 1748.

A French translation of *Siris* appeared at Amsterdam in 1745. It is entitled *Recherches sur les Vertus de l'eau de Goudron, où l'on a joint des Reflexions Philosophiques sur divers autres sujets importans.* Berkeley's *First Letter to Prior* is translated in this volume, which also includes a letter addressed to the author of the German translation of *Siris.* The French translation is referred to in the *Acta Eruditorum,* Leips. 1746, pp. 446–449.

Part of *Siris* was translated into German at Göttingen in 1746; but only the parts which relate to the preparation and medicinal properties of tar-water, along with several tracts on the subject, including Berkeley's *Letters* to Prior, and the volume contains an account of some German analyses of tar-water[1].

obvious. Berkeley repeatedly refers in *Siris* to the Paracelsic chemistry.

The subject is pursued in *Notes and Queries,* Second Series, vol. XII. 161–163, 181–183. The writer (p. 163) suggests that it was with reference to the *Aurea Catena Homeri,* 'that Bishop Berkeley wrote and named that most strange yet most choice composition, his *Siris*; which, announced as an Essay on Tar-water, begins with Tar and ends with the Trinity, the *omne scibile* forming the interspace; an essay which, in spite of the Tar-water, must delight the heart of every Platonist.'

Berkeley's Chain or Scale in *Siris* is the gradation of physical effects linked to physical causes, in successively ascending circles, from tar-water to Supreme Mind, of which physical causes are merely the passive instruments and interpretable signs. According to *Siris,* this chain of physical causes, which are all in turn effects, is at last physically enchained by invisible Fire, itself immediately dependent on Supreme Active Reason. So Bacon:—'When a man seeth the dependence of causes, and the works of Providence, then, according to the allegory of the poets, he will easily believe that the highest link of Nature's Chain must needs be tied to the foot of Jupiter's chair.'—(*Adv. of Learning,* p. 12.)

[1] I have not seen this translation. I am indebted for an account

Prior mentions translations of *Siris* into Low Dutch and Portuguese, which, as well as the French and German translations, must have been in circulation in 1746. The Dutch version was published at Amsterdam in 1745. Of the Portuguese one I have not been able to obtain any further account.

The use of tar-water as a medicine soon became widely known in Europe. No work of Berkeley's produced so extensive and sudden a sensation as *Siris*. This was not on account of the uncommon metaphysical thought by which it was pervaded, but because it offered a Catholic remedy for the diseases of mankind. The use of tar-water as a medicine became fashionable for a time. 'It is impossible,' says Mr. Duncombe, writing to Archbishop Herring in June, 1744, 'it is impossible to write a letter now without tincturing the ink with tar-water. This is the common topic of discourse, both among the rich and poor, high and low; and the Bishop of Cloyne has made it as fashionable as going to Vauxhall or Ranelagh. However, the faculty in general and the whole posse of apothecaries are very angry both with the author and the book; which makes many people suspect it is a good thing.' To which Herring writing a few days after from York, rejoins:—'Though we are so backward in some sorts of intelligence, we are perfectly acquainted with the virtues of tar-water; some have been cured as they think, and some made sick by it: I do think it is a defect in the good bishop's recommendation of it, that he makes it a Catholicon; but I daresay he is confident he believes it such.'

of it to Dr. Ueberweg, the late distinguished Professor of Logic and Metaphysics at Königsberg. It is curious that the metaphysical part of *Siris*, having affinities both with ancient Greek and modern German speculation, has not been translated into German, nor adequately recognised as representing the later, as distinguished from the earlier, Idealism of Berkeley. The relation between the two is well unfolded in an essay by Dr. Carl V. Tower, Instructor in Philosophy in the University of Michigan (*Ann Arbor.*, 1899).

Siris was the occasion of a considerable mass of controversial tracts in the last years of Berkeley's life. Controversy was confined to the healing virtues of the proposed Panacea; the divine philosophy with which *Siris* is charged was wholly neglected. Some gave vent to the anger of 'the faculty' with an ecclesiastical intruder, whose Universal Medicine threatened to supersede them in their own province.

Berkeley further illustrated the medicinal virtues of tar-water in the three *Letters* to his friend Thomas Prior, in 1744, 1746, and 1747; the *Letter* to Dr. Hales, in 1747; and in the *Further Thoughts on Tar Water,* in 1752, which are appended to *Siris* in this edition.

Prior was as unwearied as the author of *Siris* himself in vindicating the new medicine, and in proclaiming its virtues. He communicated many cases of supposed cures to the *Dublin Journal* and the *Gentleman's Magazine.* In July, 1744, he published *An Authentic Narrative, containing a record of various Cases illustrative of the Virtues of Tar Water.* This was the germ of his larger work—*An Authentic Narrative of the Success of Tar Water in curing a great number and variety of Distempers; with Remarks and Occasional Papers relative to the Subject,* which appeared in 1746. It was dedicated to the well-known Earl of Chesterfield, who was then Lord-Lieutenant of Ireland.

About two months after *Siris* appeared, a Tar-water Dispensary was opened in London; as announced in a tract 'for the direction of patients in different diseases, published by the Proprietors of the Tar-water Warehouse, behind the Thatched House Tavern, in St. James's Street,' entitled, *The Medical Virtues of Tar-Water fully explained, by the Right Rev. Dr. George Berkeley, Lord Bishop of Cloyne in Ireland. To which is added, the Receipt for making it, and Instructions to know by the colour and taste of the Water when the Tar is good*

and of the right sort. Together with a plain Explanation of the Bishop's physical Terms. Dublin and London, 1744.

Amongst the more important tracts in the controversy to which the medicinal portion of *Siris* gave rise are the following:—

1. *Anti-Siris; or English Wisdom exemplified by various examples, but particularly the present demand for Tar-water, on so unexceptionable authority as that of a R——t R——d itinerant Chemist, and Graduate in Divinity and Metaphysics. In a Letter from a Foreign Gentleman at London to his Friend abroad.* This tract of 80 pp., which appeared in May, 1744, was one of the earliest attacks upon the new medicine.

2. *A Letter to the Right Rev. the Bishop of Cloyne, occasioned by His Lordship's Treatise on the Virtues of Tar-water. Impartially examining how far that medicine deserves the character his Lordship has given of it.* London, June, 1744. A second edition appeared later in the same year. It was criticised in—

3. *Remarks on a Letter to the Right Rev. the Bishop of Cloyne, occasioned by his Treatise of Tar-water.* July, 1744.

4. *Reflections concerning the Virtues of Tar-water. Wherein it is proved by experience that the present preparation is not founded on philosophical principles, and that, as now prepared, it may probably occasion more disease than it can possibly cure. With hints for its improvement, so as to make it a pleasant and efficacious medicine.* By H. Jackson, chemist. London, June, 1744.

5. *Siris in the Shades: A Dialogue concerning Tar-Water.* July, 1744.

6. *A Cure for the Epidemical Madness of drinking Tar-water, lately imported from Ireland by a certain R——t R——d Doctor. In a Letter to his Lordship.* By T. R., M.D. London, July, 1744.

7. *The Bishop of Cloyne defended, and Tar-water provea useful by theory and experiment. In answer to T. R., M.D.* By Philanthropos. *Ecce vox Naturæ, vox Dei.* London, August, 1744.

8. *Remarks on the Bishop of Cloyne's Siris.* By Risorius, M.A., of Oxford. London, November, 1744.

9. *An Account of Some Experiments and Observations on Tar-water: wherein is shewn the quantity of Tar that is therein. Which was read before the Royal Society.* By Stephen Hales, D.D., F.R.S. London (December), 1744. A second edition of this tract appeared in 1747 (when the author of *Siris* also addressed his *Letter* to Hales), having appended to it—

10. *A Letter to the Reverend Dr. Hales, concerning the Nature of Tar, and a Method of obtaining its medical virtues, free from its hurtful oils: whereby also the Strength of each dôse may be the better ascertained.* By Andrew Reid, Esq. Dated, London, March 25, 1747.

11. *A Proposal for the improvement of the practice of Medicine. Illustrated by an example relative to the Small Pox. To which is added a Discourse on Medicinal Indications, Specifics, Panaceas; wherein are introduced Some Remarks on a book entitled 'Siris, or the Properties of Tar-water.'* By Malcolm Flemyng, M.D. Printed for the Author at Hull, by G. Ferriby, 1748.

12. *Reflections upon Catholicons, or Universal Medicines.* By Thomas Knight, M.D. London, 1749.

After Berkeley's death, in 1753, the Tar-water controversy, occasioned by *Siris*, gradually subsided; but medical virtue in tar, less extensive than that claimed for it by Berkeley, was still recognised by physicians[1].

[1] Dr. Cullen, in his *Materia Medica* (vol. II. p. 334), written in 1789, when the rage for tar-water had ceased, says that the commendations of its patrons were often 'extravagant and ill founded'; but that those who disparaged it, while they 'had some foundation for their opinions, told many falsehoods about it.' He acknowledges

The chief interest of *Siris*, however, is metaphysical or theosophical, not medical. The claim of tar-water to be a Panacea is no longer pressed. The train of thought which its supposed virtues awakened in Berkeley's mind is of more lasting value; not only as the culmination of his life-long meditations about the Power at work in the universe in which he found himself, but also from its greater affinity with speculation in the century which followed that in which he lived. Till lately *Siris* has not been taken into account in the ordinary philosophical estimate of Berkeley, in which his supposed annihilation of the material world, on postulates of sensuous empiricism, has placed him among paradoxical sceptics, and concealed the Constructive Theism in which his thought really centres. Its mystical and hardly coherent expression, as it struggles through miscellaneous, uncriticised, and learned lore in *Siris*, in eccentric association with a disputed hypothesis in therapeutics, in part accounts for this. The chief lesson of *Siris*, like that in the *Analyst*, was lost in controversies which were only incidental to the leading conception and design of each. That the inevitable presence of mystery in human faith need not involve disintegration of faith, which the *Analyst* was intended to teach, fell out of sight in the mazes of a seven years' controversy in abstract mathematics. And the divine philosophy of *Siris*, with its suggested resolution of all the so-called 'forces' of physics into a single invisible Fire, the immediate physical organ of the Universal Power that explains the Whole, failed

its usefulness in many diseases. Its virtues he attributes to the *vegetable acid* contained in the tar, and extracted from it by water. This opinion, he says, is confirmed by Reid (in his *Letter to Dr. Hales*), who quotes Glauber and Boerhaave in support of the virtues of the acid.

A watery extract of tar contains ascetic acid, carbolic acid, and creosote. Tar itself is the volatile matter obtained by the distillation of wood, and is a very complex mixture of elements, which differ in volatility; e. g. ascetic acid, light and heavy oil of tar, and pitch. Most of them are insoluble in water.

to find its way through experiments and discussions in the *materia medica*, more practically interesting, as it seemed, and at any rate more on the level of ordinary intelligence. Berkeley has accordingly been associated with the *sensuous ideaism*[1] that was prominent in the *Principles* and *Dialogues*, rather than with the *Divine Idealism* that is latent in the less luminous aphorisms of his later years.

[1] Not Idealism.

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[1] The 'Contents' added in the later editions.

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[[1]SIRIS:]

A CHAIN OF PHILOSOPHICAL REFLEXIONS AND INQUIRIES, &c.

For Introduction to the following piece, I assure the reader that nothing could, in my present situation, have induced me to be at the pains of writing it, but a firm belief that it would prove a valuable present to the public. What entertainment soever the reasoning or notional part may afford the Mind, I will venture to say, the other part seemeth so surely calculated to do good to the Body that both must be gainers. For, if the lute be not well tuned, the musician fails of his harmony. And, in our present state, the operations of the mind so far depend on the right tone or good condition of its instrument, that anything which greatly contributes to preserve or recover the health of the Body is well worth the attention of the Mind. These considerations have moved me to communicate to the public the salutary virtues of Tar-water; to which I thought myself indispensably obliged by the duty every man owes to mankind. And, as effects are linked with their causes, my thoughts on this low but useful theme led to farther inquiries, and those on to others; remote perhaps and speculative, but I hope not altogether useless or unentertaining.

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1. In certain parts of America[2], Tar-water is made by putting a quart of cold water to a quart of tar, and stirring them well together in a vessel, which is left standing till

[1] Added in second edition.

[2] Cf. sect. 2, 17.

the tar sinks to the bottom. A glass of [1 clear] water, being poured off for a draught, is replaced by the same quantity of fresh water, the vessel being shaken and left to stand as before. And this is repeated for every glass, so long as the tar continues to impregnate the water sufficiently, which [2 appears] by the smell and taste. But, as this method produceth tar-water of [3 a nauseous kind, and] different degrees of strength, I choose to make it in the following manner: Pour a gallon of cold water on a quart of tar, and stir, [3 work,] and mix them thoroughly [3 together], with a [3 wooden] ladle or flat stick, for the space of [4 five or six] minutes; after which the vessel must stand [3 close covered and unmoved] [5 three days and nights], that the tar may have [3 full] time to subside; and then the clear water, [3 having been first carefully skimmed without shaking the vessel], is to be poured off, and kept [3 in bottles well stopped] for use[6], no more being made from the same tar, which may still serve for common [7 uses].

2. [8 The] cold infusion of tar hath been used in some of our Colonies[9], as a preservative or preparative against the

[1] Omitted in the later editions.

[2] 'will appear'—in early editions.

[3] Added in the later editions.

[4] 'three or four'—in the early editions.

[5] 'eight and forty hours'—in the early editions.

[6] [I make this water stronger than that first prescribed in *Siris*, having found, on more general experience, that five or six minutes' stirring, when the water is carefully cleared and skimmed, agrees with most stomachs.]—AUTHOR. This note was added in the later editions.

[7] 'uses'—'purposes,' in the early editions. The manner of making tar-water, as well as the quality of the tar, is a very important consideration with Berkeley; cf. sect. 115. See also his *First Letter to Thomas Prior*, sect. 2; *Second Letter*, sect. 2-5; *Letter to Dr. Hales*; and *Farther Thoughts on Tar-water*. The variations in the directions given in the successive editions of *Siris*, and also of the other works, are curious. Establishments for the manufacture of tar-water, according to Berkeley's rules, were opened in London, Dublin, Göttingen, and elsewhere, soon after the appearance of *Siris*.

[8] 'This'—in the early editions.

[9] He refers to our American Colonies (cf. sect. 17), where tar-water was used medicinally among the Indians and others, as he seems to have learned in Rhode Island. His trial of the remedy when small-pox prevailed at Cloyne, and its apparent efficacy in various diseases (sect. 4-7), led him to farther reflexion about the principle of Causation in nature, and the

small-pox; which foreign practice induced me to try it in my own neighbourhood, when the small-pox raged with great violence[1]. And the trial fully answered my expectation: all those within my knowledge who took the tar-water having either escaped that distemper, or had it very favourably. In one family there was a remarkable instance of seven children, who came all very well through the small-pox, except one young child which could not be brought to drink tar-water as the rest had done.

3. Several were preserved from taking the small-pox by the use of this liquor; others had it in the mildest manner; and others, that they might be able to take the infection, were obliged to intermit drinking the tar-water. I have found it may be drunk with great safety and success for any length of time, and this not only before, but also during the distemper. The general rule for taking it is:—about half a pint night and morning, on an empty stomach; which quantity may be varied, according to the case and age of the patient, provided it be always taken on an empty stomach, and about two hours before or after a meal. [[2] For children and squeamish persons it may be made weaker, or given little and often; more water or less stirring makes it weaker, as less water or more stirring makes it stronger. It should not be lighter than French, nor deeper coloured than Spanish white wine. If a spirit be not very sensibly perceived on drinking, either the tar must have been bad, or already used, or the tar-water carelessly made or kept. Particular experience will best shew how much and how strong the stomach can bear, and what are the properest times for taking it. I apprehend no danger from excess in the use of this medicine.]

4. It seemed probable that a medicine of such efficacy in a distemper attended with so many purulent ulcers might be also useful in other foulnesses of the blood; accordingly, I tried it on several persons infected with cutaneous eruptions and ulcers, who were soon relieved, and soon after cured. Encouraged by these successes, I ventured to advise it in the foulest distempers, wherein it proved

ulterior physical and metaphysical speculation of *Siris*.

[1] At Cloyne in 1741.

[2] Added in the later editions. Cf. sect. 115.

much more successful than salivations and wood drinks had done.

5. Having tried it in a great variety of cases, I found it succeeded beyond my hopes: in a tedious and painful ulceration of the bowels; in a consumptive cough, and (as appeared by expectorated pus) an ulcer in the lungs; in a pleurisy and peripneumony. And when a person who for some years had been subject to erysipelatous fevers perceived the usual forerunning symptoms to come on, I advised her to drink tar-water, which prevented the erysipelas.

6. I never knew anything so good for the stomach[1] as tar-water: it cures indigestion and gives a good appetite. It is an excellent medicine in an asthma. It imparts a kindly warmth and quick circulation to the juices without heating, and is therefore useful, not only as a pectoral and balsamic, but also as a powerful and safe deobstruent in cachetic and hysteric cases. As it is both healing and diuretic, it is very good for the gravel. I believe it to be of great use in dropsy, having known it cure a very bad anarsaca in a person whose thirst, though very extraordinary, was in a short time removed by the drinking of tar-water[2].

7. The usefulness of this medicine in inflammatory cases is evident, from what has been already observed. (Sect. 5.) And yet some perhaps may suspect that, as the tar itself is sulphureous, tar-water must be of a hot and inflaming nature[3]. But it is to be noted that all balsams contain an acid spirit, which is in truth a volatile salt. Water is a menstruum that dissolves all sorts of salts, and draws them from their subjects. Tar, therefore, being

[1] This is repeated in various places. Cf. sect. 21, 68, 80, 87, &c. The tonic properties of tar-water were generally appreciated, with the support of high medical authority.

[2] In short, it is regarded by him as a Panacea.

[3] This objection to tar-water is urged in several of the letters and pamphlets written against the supposed Panacea. Berkeley here replied by anticipation. Cf. sect. 74–79. The objection was afterwards put in fiery language by Dr. Knight, in his *Reflections upon Catholicons*. Prior, in his *Authentic Narrative* (pp. 159–60), quotes a letter by 'Dr. De Linden, a German physician now in London,' in refutation of the error—by him erroneously attributed to *Siris*—that tar-water is heating, and tends to produce inflammation in the blood.

a balsam, its salutary acid is extracted by water; which yet is incapable of dissolving its gross resinous parts, whose proper menstruum is spirit of wine. Therefore tar-water, not being impregnated with resin, may be safely used in inflammatory cases: and in fact it hath been found an admirable febrifuge, at once the safest cooler and cordial.

8. The volatile salts[1] separated by infusion from tar, may be supposed to contain its specific virtues. Mr. Boyle and other later chemists are agreed that fixed salts are much the same in all bodies. But it is well known that volatile salts do greatly differ, and the easier they are separated from the subject, the more do they possess of its specific qualities. Now the most easy separation is, by the infusion of tar in cold water, which to smell and taste shewing itself well impregnated may be presumed to extract and retain the most pure volatile and active particles of that vegetable balsam.

9. Tar was by the ancients esteemed good against poisons, ulcers, the bites of venomous creatures; also for phthisical, scrofulous, paralytic, and asthmatic persons[2]. But the method of rendering it an inoffensive medicine and agreeable to the stomach, by extracting its virtues in cold water, was unknown to them. The leaves and tender tops of pine and fir are in our times used for diet drinks, and allowed to be antiscorbutic and diuretic. But the most elaborate juice, salt, and spirit of evergreens, are to be found in tar; whose virtues extend not to animals alone, but also to vegetables. Mr. Evelyn, in his treatise on *Forest Trees*[3], observes with wonder, that stems of trees, smeared over with tar, are preserved thereby from being hurt by the invenomed teeth of goats, and other injuries, while every other thing of an unctuous nature is highly prejudicial to them.

[1] Cf. sect. 123.

[2] See Pliny, *Hist. Nat.* Lib. XXIV. c. 22–26. It seems that the first use of tar was medicinal.

[3] *Sylva: or a Discourse on Forest Trees, and the Propagation of Timber in His Majesty's Dominions* (1664). John Evelyn (1620–1706)—'Sylva Evelyn'—the typical English gentleman and royalist of his time, eminent in natural science, and also in philanthropic service. His interesting *Memoirs* were published in 1818.

10. It seems that tar and turpentine may be had, more or less, from all sorts of pines and firs whatsoever; and that the native spirits and essential salts of those vegetables are the same in turpentine and common tar[1]. In effect, this vulgar tar, which cheapness and plenty may have rendered contemptible, appears to be an excellent balsam, containing the virtues of most other balsams; which it easily imparts to water, and by that means readily and inoffensively insinuates them into the habit of the body.

11. The resinous exudations of pines and firs are an important branch of the materia medica, and not only useful in the prescriptions of physicians, but have been also thought otherwise conducive to health. Pliny[2] tells us that wines in the time of the old Romans were medicated with pitch and resin; and Jonstonus in his *Dendrographia*[3] observes, that it is wholesome to walk in groves of pine-trees, which impregnate the air with balsamic particles. That all turpentines and resins are good for the lungs, against gravel also and obstructions, is no secret. And that the medicinal properties of those drugs are found in tar-water, without heating the blood, or disordering the stomach, is confirmed by experience; and particularly, that phthisical and asthmatic persons receive speedy and great relief from the use of it.

12. Balsams, as all unctuous and oily medicines, create a nauseating in the stomach. They cannot therefore be taken in substance so much or so long as to produce all those salutary effects, which, if thoroughly mixed with the blood and juices, they would be capable of producing. It must therefore be a thing of great benefit to be able to introduce any requisite quantity of their volatile parts into the finest ducts and capillaries, so as not to offend the stomach, but, on the contrary, to comfort and strengthen it in a great degree.

[1] The sources of the resins, vegetable tar, pitch, and turpentine, as well as various modes of procuring them, in use in ancient and modern times, are mentioned in sect. 10–28.

[2] *Hist. Nat.* Lib. XIV. c. 25.

[3] *Dendrographiæ, sive Historiæ Naturalis de arboribus et fruticibus, tam nostri quam peregrini orbis libri* (Francf., 1662). Joannes Jonstonus, M.D. (1603–1675), a Polish naturalist, author of works in botany and zoology.

13. According to Pliny[1], liquid pitch (as he calls it) or tar was obtained by setting fire to billets of old fat pines or firs. The first running was tar, the latter or thicker running was pitch. Theophrastus[2] is more particular: he tells us the Macedonians made huge heaps of the cloven trunks of those trees, wherein the billets were placed erect beside each other: that such heaps or piles of wood were sometimes a hundred and eighty cubits round, and sixty or even a hundred high: and that, having covered them with sods of earth to prevent the flame from bursting forth (in which case the tar was lost), they set on fire those huge heaps of pine or fir, letting the tar and pitch run out in a channel.

14. Pliny[3] saith, it was customary for the ancients to hold fleeces of wool over the steam of boiling tar, and squeeze the moisture from them, which watery substance was called *pissinum*. Ray[4] will have this to be the same with the *pisselæum* of the ancients; but Hardouin, in his notes on Pliny, thinks the *pisselæum* to have been produced from the cones of cedars. What use they made of these liquors anciently I know not; but it may be presumed they were used in medicine, though at present, for aught I can find, they are not used at all.

15. From the manner of procuring tar (sect. 13) it plainly appears to be a natural production, lodged in the vessels of the tree, whence it is only freed and let loose (not made) by burning. If we may believe Pliny[5], the first running or tar was called *cedrium*, and was of such efficacy to preserve from putrefaction that in Egypt they embalmed dead bodies with it. And to this he ascribes their mummies continuing uncorrupted for so many ages.

[1] *Hist. Nat.* Lib. XVI. c. 22.

[2] *Hist. Plant.* Lib. IX. c. 3. This work of Theophrastus, a pupil of Aristotle, referred to in this and in the following sections, is the oldest extant treatise in botany and vegetable physiology. Pliny, so often quoted in this part of *Siris*, who describes more than a thousand species of plants, is the next great authority, in chronological order, in this department. Thereafter little progress was made until the study revived in modern times.

[3] *Hist. Nat.* Lib. XV. c. 7.

[4] This and similar references (sect. 20, 25) are to the *Historia Plantarum* (1694) of John Ray (1628–1705), the English naturalist of the seventeenth century, well known also as author of the *Wisdom of God in the Works of the Creation*. See his *Hist. Plant.* Lib. XXV.

[5] *Hist. Nat.* Lib. XVI. c. 21.

16. Some modern writers inform us that tar flows from the trunks of pines and firs, when they are very old, through incisions made in the bark near the root; that pitch is tar inspissated[1]; and both are the oil of the tree grown thick and ripened with age and sun. The trees, like old men, being unable to perspire, and their secretory ducts obstructed, they are, as one may say, choked and stuffed with their own juice.

17. The method used by our Colonies in America for making tar and pitch is in effect the same with that of the ancient Macedonians; as appears from the account given in the *Philosophical Transactions*[2]. And the relation of Leo Africanus[3], who describes, as an eye-witness, the making of tar on Mount Atlas, agrees in substance with the methods used by the Macedonians of old, and the people of New England at this day.

18. Jonstonus, in his *Dendrographia*, is of opinion, that pitch was anciently made of cedar, as well as of the pine and fir grown old and oily. It should seem indeed that one and the same word was used by the ancients in a large sense, so as to comprehend the juices issuing from all those trees. Tar and all sorts of exudations from evergreens are, in a general acceptation, included under the name resin. Hard coarse resin or dry pitch is made from tar, by letting it blaze till the moisture is spent. Liquid resin is properly an oily viscid juice oozing from the bark of evergreen trees, either spontaneously or by incision. It is thought to be the oil of the bark inspissated by the sun. As it issues from the tree it is liquid, but becomes dry and hard, being condensed by the sun or by fire.

19. According to Theophrastus[4], resin was obtained by stripping off the bark from pines, and by incisions made in the silver fir and the pitch pine. The inhabitants of

[1] 'inspissated'—'thickened'—a term used by Evelyn; also by Bacon and others.

[2] In the *Philos. Trans.*, No. 243, we have an account of the way of making tar at Marseilles. See also No. 228.

[3] In the *Africæ Descriptio* of this learned Moor. Leo (cir. 1470–1530) made extensive journeys in the north of Africa about the beginning of the sixteenth century. His book has been translated from the original Arabic into various languages. An English version appeared in 1600.

[4] *Hist. Plant.* Lib. IX. c. 2. A similar account of the way of extracting resin from pine is given by Pliny.

Mount Ida, he tells us, stripped the trunk of the pine on the sunny side two or three cubits from the ground. He observes that a good pine might be made to yield resin every year; an indifferent every other year; and the weaker trees once in three years; and that three runnings were as much as a tree could bear. It is remarked by the same author that a pine doth not at once produce fruit and resin, but the former only in its youth, the latter in its old age.

20. Turpentine is a fine resin. Four kinds of this are in use. The turpentine of Chios or Cyprus, which flows from the turpentine tree: the Venice turpentine, which is got by piercing the larch tree: the Strasburgh turpentine, which Mr. Ray informs us is procured from the knots of the silver fir; it is fragrant and grows yellow with age: the fourth kind is common turpentine, neither transparent nor so liquid as the former; and this Mr. Ray taketh to flow from the mountain pine. All these turpentines are useful in the same intentions. Theophrastus [1] saith, the best resin or turpentine is got from the *terebinthus* growing in Syria and some of the Greek islands. The next best from the silver fir and pitch pine.

21. Turpentine is on all hands allowed to have great medicinal virtues. Tar and its infusion contain those virtues. Tar-water is extremely pectoral and restorative; and, if I may judge from what experience I have had, it possesseth the most valuable qualities ascribed to the several balsams of Peru, of Tolu, of Capivi, and even to the balm of Gilead; such is its virtue in asthmas and pleurisies, in obstructions and ulcerous erosions of the inward parts. Tar in substance mixed with honey I have found an excellent medicine for coughs. Balsams, as hath been already observed, are apt to offend the stomach, but tar-water may be taken without offending the stomach. For the strengthening whereof it is the best medicine I have ever tried.

22. The folly of man rateth things by their scarceness, but Providence hath made the most useful things most common. Among those liquid oily extracts from trees and shrubs which are termed balsams, and valued for

[1] See *Hist. Plant.* Lib. IX. c. 2. The passages of Theophrastus referred to, in sect. 25, 28, 39, are in this and the following chapter.

medicinal virtues, tar may hold its place as a most valuable balsam. Its fragrancy sheweth that it is possessed of active qualities, and its oiliness that it is fitted to retain them. This excellent balsam may be purchased for a penny a pound, whereas the balsam of Judea, when most plenty, was sold on the very spot that produced it, for double its weight in silver, if we may credit Pliny[1]; who also informs us, that the best balsam of Judea flowed only from the bark, and that it was adulterated with resin and oil of turpentine. Now, comparing the virtues I have experienced in tar with those I find ascribed to the precious balm of Judea, of Gilead, or of Mecha, (as it is diversly called), I am of opinion that the latter is not a medicine of more value or efficacy than the former.

23. Pliny[2] supposed amber to be a resin, and to distil from some species of pine—which he gathered from its smell. Nevertheless, its being dug out of the earth shews it to be a fossil, though of a very different kind from other fossils. But thus much is certain, that the medicinal virtues of amber are to be found in the balsamic juices of pines and firs. Particularly the virtues of the most valuable preparation, I mean salt of amber, are in a great degree answered by tar-water, as a detergent, diaphoretic, and diuretic.

24. There is, as hath been already observed, more or less oil and balsam in all evergreen trees, which retains the acid spirit, that principle of life and verdure; the not retaining whereof in sufficient quantity causeth other plants to droop and wither. Of these evergreen trees productive of resin, pitch and tar, Pliny[3] enumerates six kinds in Europe; Jonstonus reckons up thrice that number of the pine and fir family. And, indeed, their number, their variety, and their likeness, make it difficult to be exact.

25. It is remarked, both by Theophrastus and Jonstonus, that trees growing in low and shady places do not yield so good tar as those which grow in higher and more exposed situations[4]. And Theophrastus farther observes,

[1] *Hist. Nat.* Lib. XII. c. 54.
[2] *Ibid.* Lib. XXXVII. c. 11.
[3] *Ibid.* Lib. XVI. c. 16–19.
[4] Cf. sect. 28. Berkeley lays stress, for medicinal purposes, on the quality of the tar. 'As there is as great difference in tar as in any commodity whatsoever,' says

that the inhabitants of Mount Ida in Asia, who distinguish the Idean pine from the maritime, affirm, that the tar flowing from the former is in greater plenty, as well as more fragrant than the other. Hence, it should seem the pines or firs in the mountains of Scotland might be employed that way, and rendered valuable; even where the timber, by its remoteness from water carriage, is of small value. What we call the Scotch fir is falsely so called, being in truth a wild forest pine, and (as Mr. Ray informs us) agreeing much with the description of a pine growing on Mount Olympus in Phrygia, probably the only place where it is found out of these islands; in which of late years it is so much planted and cultivated with so little advantage, while the cedar of Lebanon might perhaps be raised, with little more trouble, and much more profit and ornament.

26. The pines, which differ from the firs in the length and disposition of their leaves and hardness of the wood, do not, in Pliny's [1] account, yield so much resin as the fir-trees. Several species of both are accurately described and delineated by the naturalists. But they all agree so far as to seem related. Theophrastus gives the preference to that resin which is got from the silver fir and pitch-tree (ἐλάτη and πίτυς) before that yielded by the pine, which yet he saith is in greater plenty. Pliny [2], on the contrary, affirms that the pine produceth the smallest quantity. It should seem therefore that the interpreter of Theophrastus might have been mistaken, in rendering πεύκη by *pinus*; as well as Jonstonus, who likewise takes the pine for the πεύκη of Theophrastus. Hardouin will have the pinus of Pliny to have been by others called πεύκη, but by Theophrastus

the author of *The Medical Virtues of Tar Water* (1744), 'the persons who intend to make it are cautioned as to the following particulars, lest Plantation tar, or tar used before, should be imposed upon them. The true properties of the right tar-water are that there should be an acid in the taste; the water when made should be as transparent as sherry; and the smell quite even, and no way offensive to any but those who have an antipathy to the smell of tar in general. Whereas the other has none of the acid; *which is the principal advantageous property.*' North American, but especially Norwegian, tar is recommended. The tar of the Thuringian forest was also in high esteem.

[1] *Hist. Nat.* Lib. XVI. c. 16–18. See also Hardouin's notes on Pliny.

[2] *Ibid.*

πίτυς. Ray thinks the common fir, or *picea* of the Latins, to be the male fir of Theophrastus. This was probably the spruce fir; for the *picea*, according to Pliny[1], yields much resin, loves a cold and mountainous situation, and is distinguished, *tonsili facilitate*, by its fitness to be shorn, which agrees with the spruce-fir, whereof I have seen close-shorn hedges.

27. There seems to have been some confusion in the naming of these trees, as well among the ancients as the moderns. The ancient Greek and Latin names are by later authors applied very differently. Pliny[2] himself acknowledgeth it is not easy even for the skilful to distinguish the trees by their leaves, and know their sexes and kinds; and that difficulty is since much increased, by the discovery of many new species of that evergreen tribe, growing in various parts of the globe. But descriptions are not so easily misapplied as names. Theophrastus tells that πίτυς differeth from πεύκη among other things, in that it is neither so tall nor so straight, nor hath so large a leaf. The fir he distinguisheth into male and female: the latter is softer timber than the male; it is also a taller and fairer tree, and this is probably the silver fir.

28. To say no more on this obscure business, which I leave to the critics, I shall observe that according to Theophrastus not only the turpentine-trees, the pines, and the firs yield resin or tar, but also the cedars and palm-trees; and the words *pix* and *resina* are taken by Pliny in so large a sense as to include the weepings of the lentiscus and cypress, and the balms of Arabia and Judea; all which perhaps are near of kin, and in their most useful qualities concur with common tar, especially the Norwegian, which is the most liquid, and best for medicinal uses of any that I have experienced. Those trees that grow on mountains, exposed to the sun or the north wind[3], are reckoned by Theophrastus to produce the best and purest tar; and the Idæan pines were distinguished from those growing on the plain, as yielding a thinner, sweeter, and better scented tar; all which differences I think I have observed, between the tar that comes from Norway, and that which comes from low and swampy countries.

[1] *Hist. Nat.* Lib. XVI. c. 18. See Hardouin's notes on Pliny.
[2] *Ibid.* c. 19. [3] Cf. sect. 25.

29. Agreeable to the old observation of the Peripatetics, that heat gathereth homogeneous things, and disperseth such as are heterogeneous, we find Chemistry is fitted for the analysis of bodies[1]. But the chemistry of nature is much more perfect than that of human art, inasmuch as it joineth to the power of heat that of the most exquisite mechanism. Those who have examined the structure of trees and plants by microscopes have discovered an admirable variety of fine capillary tubes and vessels, fitted for several purposes, as the imbibing or attracting of proper nourishment, the distributing thereof through all parts of the vegetable, the discharge of superfluities, the secretion of particular juices. They are found to have ducts answering to the tracheæ in animals, for the conveying of air; they have others answering to lacteals, arteries, and veins. They feed, digest, respire, perspire, and generate their kind, and are provided with organs nicely fitted for all those uses.

30. The sap vessels are observed to be fine tubes running up through the trunk from the root. Secretory vessels are found in the bark, buds, leaves, and flowers. Exhaling vessels, for carrying off excrementitious parts, are discovered throughout the whole surface of the vegetable. And (though this point be not so well agreed) Dr. Grew, in his *Anatomy of Plants*[2], thinks there appears a circulation of the sap, moving downwards in the root, and feeding the trunk upwards.

31. Some difference indeed there is between learned men, concerning the proper use of certain parts of

[1] In sect. 29–39 we have speculation about the anatomy and physiology of vegetables, and their analogy to animal organisms. They breathe, feed, digest, perspire, and generate; and pines and firs especially, under the action of the sun, secrete a balsam, which, perspiring through the bark, hardens into resin. It is this secretion, so tenacious of the *acid spirit* or *vegetable soul*, which is, he suggests, through a natural chemistry, transformed into a Panacea in tar.

[2] *The Anatomy of Plants: with an Idea of the Philosophical History of Plants*, by Nehemiah Grew, M.D. London, 1682. See Bk. I. ch. 2. § 30. Grew (1628–1712) was secretary to the Royal Society, and an eminent English botanist of his day, author of works which laid the foundation of Vegetable Physiology. The microscope was then initiating important discoveries. Grew, Ray, and Malpighi, are the three great modern botanists before Linnæus.

vegetables. But, whether the discoverers have rightly guessed at all their uses or no, thus much is certain—that there are innumerable fine and curious parts in a vegetable body, and a wonderful similitude or analogy between the mechanism of plants and animals. And perhaps some will think it not unreasonable to suppose the mechanism of plants more curious than even that of animals, if we consider not only the several juices secreted by different parts of the same plant, but also the endless variety of juices drawn and formed out of the same soil, by various species of vegetables; which must therefore differ in an endless variety, as to the texture of their absorbent vessels and secretory ducts.

32. A body, therefore, either animal or vegetable, may be considered as an organised system of tubes and vessels, containing several sorts of fluids. And as fluids are moved through the vessels of animal bodies by the systole and diastole of the heart, the alternate expansion and condensation of the air, and the oscillations in the membranes and tunics of the vessels—even so, by means of air expanded and contracted in the tracheæ, or vessels made up of elastic fibres, the sap is propelled through the arterial tubes of a plant, and the vegetable juices, as they are rarefied by heat or condensed by cold, will either ascend and evaporate into air, or descend in the form of a gross liquor.

33. Juices, therefore, first purified by straining through the fine pores of the root, are afterwards exalted by the action of the air and the vessels of the plant; but, above all, by the action of the sun's light; which, at the same time that it heats, doth wonderfully rarefy and raise the sap, till it perspires and forms an atmosphere, like the effluvia of animal bodies. And, though the leaves are supposed to perform principally the office of lungs, breathing out excrementitious vapours, and drawing in alimentary; yet it seems probable, that the reciprocal actions of repulsion and attraction are performed all over the surface of vegetables as well as animals. In which reciprocation Hippocrates[1] supposeth the manner of nature's acting for the nourishment and health of animal bodies

[1] *Opera*, tom. I. pp. 629, &c. (ed. Lips. 1825)—in the treatise *De Diæta*.

chiefly to consist. And, indeed, what share of a plant's nourishment is drawn, through the leaves and bark, from that ambient heterogeneous fluid called air, is not easy to say. It seems very considerable, and altogether necessary, as well to vegetable as animal life.

34. It is an opinion received by many, that the sap circulates in plants as the blood in animals; that it ascends through capillary arteries in the trunk, into which are inosculated other vessels of the bark answering to veins, which bring back to the root the remainder of the sap, over and above what had been deposited during its ascent by the arterial vessels, and secreted for the several uses of the vegetable throughout all its parts, stem, branches, leaves, flowers, and fruit. Others deny this circulation, and affirm that the sap doth not return through the bark vessels. It is nevertheless agreed by all that there are ascending and descending juices; while some will have the ascent and descent to be a circulation of the same juices through different vessels; others will have the ascending juice to be one sort attracted by the root, and the descending another imbibed by the leaves, or extremities of the branches; lastly, others think that the same juice, as it is rarefied or condensed by heat or cold, rises and subsides in the same tube. I shall not take upon me to decide this controversy. Only I cannot help observing that the vulgar argument from analogy between plants and animals loses much of its force, if it be considered that the supposed circulating of the sap, from the root or lacteals through the arteries, and thence returning, by inosculations, through the veins or bark vessels to the root or lacteals again, is in no sort conformable or analogous to the circulation of the blood.

35. It is sufficient to observe, what all must acknowledge, that a plant or tree is a very nice and complicated machine (sect. 30, 31); by the several parts and motions whereof, the crude juices, admitted through the absorbent vessels, whether of the root, trunk, or branches, are variously mixed, separated, altered, digested, and exalted, in a very wonderful manner. The juice, as it passeth in and out, up and down, through tubes of different textures, shapes, and sizes, and is affected by the alternate compression and expansion of elastic vessels, by the vicissitudes of seasons,

the changes of weather, and the various action of the solar light, grows still more and more elaborate.

36. There is therefore no chemistry like that of nature, which addeth to the force of fire the most delicate, various, and artificial percolation (sect. 29). The incessant action of the sun upon the elements of air, earth, and water, and on all sorts of mixed bodies, animal, vegetable, and fossil, is supposed to perform all sorts of chemical operations. Whence it should follow, that the air contains all sorts of chemic productions, the vapours, fumes, oils, salts, and spirits of all the bodies we know: from which general aggregate or mass, those that are proper being drawn in, through the fine vessels of the leaves, branches, and stem of the tree, undergo, in its various organs, new alterations, secretions, and digestions, till such time as they assume the most elaborate form.

37. Nor is it to be wondered that the peculiar texture of each plant or tree, co-operating with the solar fire[1] and pre-existing juices, should so alter the fine nourishment drawn from earth and air (sect. 33), as to produce various specific qualities of great efficacy in medicine; especially if it be considered that in the opinion of learned men, there is an influence on plants derived from the sun, besides its mere heat. Certainly, Dr. Grew, that curious anatomist of plants, holds the solar influence[1] to differ from that of a mere culinary fire no otherwise than by being only a more temperate and equal heat.

38. The alimentary juice taken into the lacteals, [[2] if I may so say, of vegetables,] consists of oily, aqueous, and saline particles, which being dissolved, volatilised, and diversely agitated, part thereof is spent and exhaled into the air; and that part which remains is, by the economy of the plant, and action of the sun, strained, purified, concocted, and ripened, into an inspissated oil or balsam, and deposited in certain cells placed chiefly in the bark, which is thought to answer the *panniculus adiposus* in animals, defending trees from the weather, and, when in

[1] Cf. Berkeley's *First Letter to Thomas Prior, on the Virtues of Tar-water*, sect. 16, 17, where he professes 'the ancient opinion, that Fire is the animal spirit of the visible world.' See also Grew's *Idea of a Philosophical History of Plants*, § 61.

[2] 'whether of animals or vegetables'—in first edition.

sufficient quantity, rendering them evergreen. This balsam, weeping or sweating through the bark, hardens into resin; and this most copiously in the several species of pines and firs, whose oil being in greater quantity, and more tenacious of the acid spirit, or vegetable soul (as perhaps it may not improperly be called), abides the action of the sun, and, attracting the sunbeams, is thereby exalted and enriched, so as to become a most noble medicine: such is the last product of a tree, perfectly maturated by time and sun.

39. It is remarked by Theophrastus that all plants and trees while they put forth have most humour, but when they have ceased to germinate and bear, then the humour is strongest, and most sheweth the nature of the plant, and that, therefore, trees yielding resin should be cut after germination. It seems also very reasonable to suppose the juice of old trees, whose organs bring no new sap, should be better ripened than that of others.

40. The aromatic flavours of vegetables seem to depend upon the sun's light as much as colours[1]. As in the production of the latter, the reflecting powers of the object, so in that of the former, the attractive and organical powers of the plant co-operate with the sun (sect. 36, 37). And as from Sir Isaac Newton's experiments it appears that all colours are virtually in the white light of the sun, and shew themselves when the rays are separated by the attracting and repelling powers of objects—even so the specific qualities of the elaborate juices of plants seem to be virtually or eminently contained in the solar light, and are actually exhibited upon the separation of the rays, by the peculiar powers of the capillary organs in vegetables, attracting and imbibing certain rays, which produce certain flavours and qualities, in like manner as certain rays, being reflected, produce certain colours.

[1] This and the following sections discuss the already noted qualities of the juice of plants, especially pines and firs. The solar emanation contained in this, according to the 'fire philosophy' of *Siris*, constitutes the *soul* of vegetable life, and is to the Macrocosm what its animal spirit is to the microcosm. Sanitary properties of light are now universally recognised, alike in the case of animals and vegetables.

41. It hath been observed by some curious anatomists that the secretory vessels in the glands of animal bodies are lined with a fine down, which in different glands is of different colours. And it is thought that each particular down, being originally imbued with its own proper juice, attracts none but that sort; by which means so many various juices are secreted in different parts of the body. And perhaps there may be something analogous to this in the fine absorbent vessels of plants, which may co-operate towards producing that endless variety of juices, elaborated in plants from the same earth and air.

42. The balsam or essential oil of vegetables contains a spirit, wherein consist the specific qualities, the smell and taste, of the plant. Boerhaave[1] holds the native presiding spirit to be neither oil, salt, earth, or water; but somewhat too fine and subtle to be caught alone and rendered visible to the eye. This when suffered to fly off, for instance, from the oil of rosemary, leaves it destitute of all flavour. This spark of life, this spirit or soul, if we may so say, of the vegetable departs without any sensible diminution of the oil or water wherein it was lodged.

43. It should seem that the forms, souls, or principles of vegetable life subsist in the light or solar emanation (sect. 40); which in respect of the macrocosm is what the animal spirit is to the microcosm—the interior tegument, the subtle instrument and vehicle of power. No wonder, then, that the *ens primum* or *scintilla spirituosa*, as it is called, of plants should be a thing so fine and fugacious as to escape our nicest search. It is evident that nature at the sun's approach vegetates, and languishes at his recess; this terrestrial globe seeming only a matrix disposed and prepared to receive life from his light; whence Homer in his Hymns styleth earth the wife of heaven, ἄλοχ' οὐρανοῦ ἀστερόεντος.

44. The luminous spirit which is the form or life of a plant, from whence its differences and properties flow, is somewhat extremely volatile. It is not the oil, but a thing more subtle, whereof oil is the vehicle, which retains it from flying off, and is lodged in several parts of the plant, particularly in the cells of the bark and in the seeds.

[1] Boerhaave (1668-1738,—the most illustrious physician of the eighteenth century. See his *Elementa Chemiæ*, tom. II. pp. 149-50.

This oil, purified and exalted by the organical powers of the plant, and agitated by warmth, becomes a proper receptacle of the spirit: part of which spirit exhales through the leaves and flowers, and part is arrested by this unctuous humour that detains it in the plant. It is to be noted this essential oil, animated, as one may say, with the flavour of the plant, is very different from any spirit that can be procured from the same plant by fermentation.

45. Light impregnates air (sect. 37, 43), air impregnates vapour; and this becomes a watery juice by distillation, having risen first in the cold still with a kindly gentle heat. This fragrant vegetable water is possessed of the specific odour and taste of the plant. It is remarked that distilled oils added to water for counterfeiting the vegetable water can never equal it, artificial chemistry falling short of the natural.

46. The less violence is used to nature the better its produce. The juice of olives or grapes issuing by the lightest pressure is best. Resins that drop from the branches spontaneously, or ooze upon the slightest incision, are the finest and most fragrant. And infusions are observed to act more strongly than decoctions of plants; the more subtle and volatile salts and spirits, which might be lost or corrupted by the latter, being obtained in their natural state by the former. It is also observed that the finest, purest, and most volatile part is that which first ascends in distillation. And, indeed, it should seem the lightest and most active particles required least force to disengage them from the subject.

47. The salts, therefore, and more active spirits of the tar are got by infusion in cold water; but the resinous part is not to be dissolved thereby (sect. 7). Hence the prejudice which some perhaps may entertain against tar-water as a medicine, the use whereof might inflame the blood by its sulphur and resin, appears to be not well grounded; it being indeed impregnated with a fine acid spirit, balsamic, cooling, diuretic, and possessed of many other virtues (sect. 42, 44). Spirits are supposed to consist of salts and phlegm, probably, too, somewhat of a fine oily nature, differing from oil in that it mixeth with water, and agreeing with oil in that it runneth in rivulets by distillation. Thus much is allowed, that the water, earth, and

fixed salt are the same in all plants; that, therefore, which differenceth a plant, or makes it what it is—the *native spark* or *form*—in the language of the chemists or schools—is none of those things; nor yet the finest oil, which seemeth only its receptacle or vehicle. It is observed by chemists that all sorts of balsamic wood afford an acid spirit, which is the volatile oily salt of the vegetable; herein are chiefly contained their medicinal virtues; and, by the trials I have made, it appears that the acid spirit in tar-water possesseth the virtues, in an eminent degree, of that of *guaiacum*, and other medicinal woods.

48. Qualities in a degree too strong for human nature to subdue, and assimilate to itself must hurt the constitution. All acids, therefore, may not be useful or innocent. But this seemeth an acid so thoroughly concocted, so gentle, bland, and temperate, and withal a spirit so fine and volatile, as readily to enter the smallest vessels, and be assimilated with the utmost ease.

49. If any one were minded to dissolve some of the resin, together with the salt or spirit, he need only mix some spirit of wine with the water. But such an entire solution of resins and gums as to qualify them for entering and pervading the animal system, like the fine acid spirit that first flies off from the subject, is perhaps impossible to obtain. It is an apothegm of the chemists, derived from Helmont[1], that whoever can make myrrh soluble by the human body has the secret of prolonging his days: and Boerhaave[2] owns that there seems to be truth in this, from its resisting putrefaction. Now, this quality is as remarkable in tar, with which the ancients embalmed and preserved dead bodies. And though Boerhaave himself, and other chemists before him, have given methods for making solutions of myrrh, yet it is by means of alcohol which extracts only the inflammable parts. And it doth not seem that any solution of myrrh is impregnated with its salt or acid spirit. It may not, therefore, seem strange

[1] J. B. Van Helmont (1572-1644), probably the greatest chemist before Lavoisier. He strove to carry out the notions of Paracelsus, by whose writings he was attracted to chemistry and alchemy. The seat of the soul he placed in the stomach, offering as one reason for this, that when we hear bad news we lose our appetite for food. His works were edited by his son, F. M. Van Helmont.

[2] *Elementa Chemiæ*, tom. II. p. 231.

if this water should be found more beneficial for procuring health and long life than any solution of myrrh whatsoever.

50. Certainly divers resins and gums may have virtues, and yet not be able for their grossness to pass the lacteals and other finer vessels, nor yet, perhaps, readily impart those virtues to a menstruum that may with safety and speed convey them throughout the human body. Upon all which accounts, I believe tar-water will be found to have singular advantages. It is observed that acid spirits prove the stronger, by how much the greater degree of heat is required to raise them. And indeed there seemeth to be no acid more gentle than this, obtained by the simple affusion of cold water; which carries off from the subject the most light and subtle parts, and, if one may so speak, the very flower of its specific qualities. And here it is to be noted that the volatile salt and spirit of vegetables do, by gently stimulating the solids, attenuate the fluids contained in them, and promote secretions, and that they are penetrating and active, contrary to the general nature of other acids.

51. It is a great maxim for health, that the juices of the body be kept fluid in a due proportion. Therefore, the acid volatile spirit in tar-water, at once attenuating and cooling in a moderate degree, must greatly conduce to health, as a mild salutary deobstruent, quickening the circulation of the fluids without wounding the solids, thereby gently removing or preventing those obstructions which are the great and general cause of most chronical diseases; in this manner answering to the antihysterics, *assafœtida*, *galbanum*, myrrh, amber, and, in general, to all the resins and gums of trees or shrubs useful in nervous cases.

52. Warm water is itself a deobstruent. Therefore the infusion of tar drunk warm is easier insinuated into all the nice capillary vessels, and acts not only by virtue of the balsam, but also by that of the vehicle. Its taste, its diuretic quality, its being so great a cordial, shew the activity of this medicine. And, at the same time that it quickens the sluggish blood of the hysterical, its balsamic oily nature abates the too rapid motion of the sharp thin blood in those who are hectic. There is a lentor and smoothness in the blood of healthy strong people; on the contrary, there is often an acrimony and solution in that

of weakly morbid persons. The fine particles of tar are not only warm and active, they are also balsamic and emollient; softening and enriching the sharp and vapid blood, and healing the erosions occasioned thereby in the blood-vessels and glands.

53. Tar-water possesseth the stomachic and cardiac qualities of *elixir proprietatis*, Stoughton's drops, and many such tinctures and extracts; with this difference, that it worketh its effect more safely, as it hath nothing of that spirit of wine, which, however mixed and disguised, may yet be well accounted a poison in some degree.

54. Such medicines are supposed to be diaphoretic, which, being of an active and subtle nature, pass through the whole system, and work their effect in the finest capillaries and perspiratory ducts, which they gently cleanse and open. Tar-water is extremely well fitted to work by such an insensible diaphoresis, by the fineness and activity of its acid volatile spirit. And surely those parts ought to be very fine, which can scour the perspiratory ducts, under the scarf skin or cuticle, if it be true, that one grain of sand would cover the mouths of more than a hundred thousand.

55. Another way wherein tar-water operates is by urine, than which perhaps none is more safe and effectual, for cleansing the blood and carrying off its salts. But it seems to produce its principal effect as an alterative, sure and easy, much safer than those vehement, purgative, emetic, and salivating medicines, which do violence to nature.

56. An obstruction of some vessels causeth the blood to move more swiftly in other vessels which are not obstructed. Hence manifold disorders. A liquor that dilutes and attenuates resolves the concretions which obstruct. Tar-water is such a liquor. It may be said, indeed, of common water, that it attenuates; also of mercurial preparations, that they attenuate. But it should be considered that mere water only distends the vessels, and thereby weakens their tone; and that mercury by its great momentum may justly be suspected of hurting the fine capillaries, which two deobstruents therefore might easily overact their parts, and (by lessening the force of the elastic vessels) remotely produce those concretions they are intended to remove.

57. Weak and rigid fibres are looked on by the most able physicians, as sources of two different classes of distempers: a sluggish motion of the liquids occasioning weak fibres: therefore tar-water is good to strengthen them, as it gently accelerates their contents. On the other hand, being an unctuous, bland fluid, it moistens and softens the dry and stiff fibres, and so proves a remedy for both extremes.

58. Common soaps are compositions of lixivial salt and oil. The corrosive acrimony of the saline particles, being softened by the mixture of an unctuous substance, they insinuate themselves into the small ducts with less difficulty and danger. The combination of these different substances makes up a very subtle and active medicine, fitted for mixing with all humours, and resolving all obstructions. Soap, therefore, is justly esteemed a most efficacious medicine in many distempers. Alkaline soap is allowed to be cleansing, attenuating, opening, resolving, sweetening; it is pectoral, vulnerary, diuretic, and hath other good qualities which are also to be found in tar-water. It is granted that oil and acid salts combined together exist in vegetables, and that consequently there are acid soaps as well as alkaline. And the saponaceous nature of the acid vegetable spirits is what renders them so diuretic, sudorific, penetrating, abstersive, and resolving. Such, for instance, is the acid spirit of *guaiacum*. And all these same virtues seem to be in tar-water in a mild and salutary degree.

59. It is the general opinion that all acids coagulate the blood. Boerhaave[1] excepts vinegar, which he holds to be a soap, inasmuch as it is found to contain an oil as well as an acid spirit. Hence it is both unctuous and penetrating, a powerful antiphlogistic, and preservative against corruption and infection. Now it seems evident that tar-water is a soap as well as vinegar. For, though it be a character of resin, which is an inspissated gross oil, not to dissolve in water (sect. 47), yet the salts attract some fine particles of essential oil: which fine oil serves as a vehicle for the acid salts, and shews itself in the colour of the tar-water: for all pure salts are colourless. And,

[1] *Elementa Chemiæ*, tom. II. p. 216

though the resin will not dissolve in water, yet the subtle oil, in which the vegetable salts are lodged, may as well mix with water as vinegar doth, which contains both oil and salt. And, as the oil in tar-water discovers itself to the eye, so the acid salts do manifest themselves to the taste. Tar-water therefore is a soap, and as such hath the medicinal qualities of soap.

60. It operates more gently as the acid salts lose their acrimony, being sheathed in oil [1], and thereby approaching the nature of neutral salts, are more benign and friendly to the animal system: and more effectually, as, by the help of a volatile, smooth, insinuating oil, those same salts are more easily introduced into the capillary ducts. Therefore, in fevers and epidemical distempers it is (and I have found it so), as well as in chronical diseases, a most safe and efficacious medicine, being good against too great fluidity as a balsamic, and good against viscidity as a soap. There is something in the fiery corrosive nature of lixivial salts, which makes alkaline soap a dangerous remedy in all cases where an inflammation is apprehended. And, as inflammations are often occasioned by obstructions, it should seem an acid soap was much the safer deobstruent.

61. Even the best turpentines, however famous for their vulnerary and detergent qualities, have yet been observed by their warmth to dispose to inflammatory tumours. But the acid spirit (sect. 7, 8) being in so great proportion in tar-water, renders it a cooler and safer medicine. And the æthereal oil of turpentine, though an admirable dryer, healer, and anodyne, when outwardly applied to wounds and ulcers, and not less useful in cleansing the urinary passages and healing their ulcerations, yet is known to be of a nature so very relaxing as sometimes to do much mischief when taken inwardly. Tar-water is not attended with the same ill effects, which I believe are owing in a great measure to the æthereal oils being deprived of the acid spirit in distillation, which, vellicating and contracting as a stimulus, might have proved a counterpoise to the excessive lubricating and relaxing qualities of the oil.

[1] Cf. Berkeley's *Letter to Thomas Prior, on the Virtues of Tar-water in the Plague* (vol. III. p. 484)—especially the reference to Andrew Reid's *Letter to Dr. Hales.* Reid recommends that the medicinal acid should be freed from its oil.

62. Woods in decoction do not seem to yield so ripe and elaborate a juice, as that which is deposited in the cells or *loculi terebinthiaci*, and spontaneously oozes from them. And indeed, though the balsam of Peru, obtained by boiling wood and scumming the decoction, be a very valuable medicine, and of great account in divers cases, particularly asthmas, nephritic pains, nervous colics, and obstructions, yet I do verily think (and I do not say this without experience) that tar-water is a more efficacious remedy in all those cases than even that costly drug.

63. It hath been already observed that the restorative pectoral antihysterical virtues of the most precious balsams and gums are possessed in a high degree by tar-water (sect. 9, 21, 22, 23). And I do not know any purpose answered by the wood drinks for which tar-water may not be used with at least equal success. It contains the virtues even of *guaiacum*, which seems the most efficacious of all woods, warming and sweetening the humours, diaphoretic and useful in gouts, dropsies, and rheums, as well as in the foul disease. Nor should it seem strange if the virtues obtained by boiling an old dry wood prove inferior to those extracted from a balsam.

64. There is a fine volatile spirit in the waters of Geronster, the most esteemed of all the fountains about the Spa[1], but whose waters do not bear transporting. The stomachic, cardiac, and diuretic qualities of this fountain somewhat resemble those of tar-water, which, if I am not greatly mistaken, contains the virtues of the best chalybeat and sulphureous waters; with this difference, that those waters are apt to affect the head in taking, which tar-water is not. Besides, there is a regimen of diet to be observed, especially with chalybeat waters, which I never found necessary with this. Tar-water layeth under no restraint either as to diet, hours, or employment. A man may study, or exercise, or repose, keep his own hours, pass his time either within or without, and take wholesome nourishment of any kind.

65. The use of mineral waters, however excellent for the nerves and stomach, is often suspended by colds and

[1] The waters of Spa have perhaps been longer in repute than any in Europe. Only one of the springs is in Spa itself; the others are at some distance in the woods.

inflammatory disorders; in which they are acknowledged to be very dangerous: whereas tar-water is so far from hurting in those cases, or being discontinued on that account, that it greatly contributes to their cure (sect. 7).

66. Cordials, vulgarly so called, act immediately on the stomach, and by consent of nerves on the head. But medicines of an operation too fine and light to produce a sensible effect in the *primæ viæ* may, nevertheless, in their passage through the capillaries, operate on the sides of those small vessels, in such manner as to quicken their oscillations, and consequently the motion of their contents, producing, in issue and effect, all the benefits of a cordial much more lasting and salutary than those of [[1] distilled] spirits, which by their caustic and coagulating qualities do incomparably more mischief than good. Such a cardiac medicine is tar-water. The transient fits of mirth, produced from fermented liquors, [[2] and distilled spirits,] are attended with proportionable depression of spirit in their intervals. But the calm cheerfulness arising from this *water of health* (as it may be justly called) is permanent. In which it emulates the virtues of that famous plant Gen Seng[3], so much valued in China as the only cordial that raises the spirits without depressing them. Tar-water is so far from hurting the nerves, as common cordials do, that it is highly useful in cramps, spasms of the viscera, and paralytic numbness.

67. Emetics are on certain occasions administered with great success. But the overstraining and weakening of nature may be very justly apprehended from a course of emetics. They are nevertheless prescribed and substituted for exercise. But it is well remarked in Plato's *Timæus*[4] that vomits and purges are the worst exercise in the world. There is something in the mild operation of tar-water, that seems more friendly to the economy, and forwards the digestions and secretions in a way more

[1] 'Fermented' in first edition.

[2] Not in the early editions.

[3] Gen (Gin) Seng is the root of an Asiatic plant (*Panax Schin-Seng*). It had long been famous among the Chinese, as a stimulant and restorative. Eminent physicians in China have written volumes on its medicinal virtues, in a variety of diseases. Don, the botanist, says that the roots, which resemble the human form, enter into most medicines used by the Tartars and Chinese.

[4] P. 89.

natural and benign; the mildness of this medicine being such that I have known children take it, for above six months together, with great benefit, and without any inconvenience: and, after long and repeated experience, I do esteem it a most excellent diet-drink, fitted to all seasons and ages.

68. It is I think allowed that the origin of the gout lies in a faulty digestion. And it is remarked by the ablest physicians, that the gout is so difficult to cure, because heating medicines aggravate its immediate, and cooling its remote cause. But tar-water, although it contains active principles that strengthen the digestion beyond anything I know, and consequently must be highly useful, either to prevent or lessen the following fit, or by invigorating the blood to cast it upon the extremities, yet it is not of so heating a nature as to do harm even in the fit. Nothing is more difficult or disagreeable than to argue men out of their prejudices; I shall not therefore enter into controversies on this subject, but, if men dispute and object, shall leave the decision to time and trial.

69. In the modern practice, soap, opium, and mercury, bid fairest for Universal Medicines. The first of these is highly spoken of. But then those who magnify it most except against the use of it, in such cases where the obstruction is attended with a putrefactive alkali, or where an inflammatory disposition appears. It is acknowledged to be very dangerous in a phthisis, fever, and some other cases in which tar-water is not only safe but useful.

70. Opium, though a medicine of great extent and efficacy, yet is frequently known to produce grievous disorders in hysterical or hypochondriacal persons; who make a great part, perhaps the greatest, of those who lead sedentary lives in these islands. Besides, upon all constitutions dangerous errors may be committed in the use of opium.

71. Mercury hath of late years become a medicine of very general use—the extreme minuteness, mobility, and momentum of its parts rendering it a most powerful cleanser of all obstructions, even in the most minute capillaries[1]. But then we should be cautious in the use

[1] Mercury was much in vogue with the Arabian alchemists. Cf. sect. 194.

of it, if we consider that the very thing which gives it power of doing good above other deobstruents doth also dispose it to do mischief. I mean its great momentum, the weight of it being about ten times that of blood, and the momentum being the joint product of the weight and velocity, it must needs operate with great force; and may it not be justly feared that so great a force, entering the minutest vessels, and breaking the obstructed matter, might also break or wound the fine tender coats of those small vessels, and so bring on the untimely effects of old age, producing more, perhaps, and worse obstructions than those it removed? Similar consequences may justly be apprehended from other mineral and ponderous medicines. Therefore, upon the whole, there will not perhaps be found any medicine more general in its use, or more salutary in its effects, than tar-water.

72. To suppose that all distempers, arising from very different, and it may be from contrary causes[1], can be cured by one and the same medicine must seem chimerical[2]. But it may with truth be affirmed, that the virtue of tar-water extends to a surprising variety of cases, very distant and unlike (sect. 3, 4, 5, 6, 21, &c.). This I have experienced in my neighbours, my family, and myself. And, as I live in a remote corner[3], among poor neighbours, who for want of a regular physician have often recourse to me, I have had frequent opportunities of trial, which convince me it is of so just a temperament as to be an enemy to all extremes. I have known it to do great good in a cold, watery constitution, as a cardiac and stomachic: and at the same time allay heat and feverish thirst in another. I have known it correct costive habits in some, and the contrary habit in others. Nor will this seem incredible if it be considered that middle qualities naturally reduce the extreme. Warm water, for instance, mixed with hot and cold, will lessen the heat in that, and the cold in this.

[1] 'causes,' i. e. physical or dependent causes, with which alone he is concerned in this part of *Siris*.

[2] Cf. the definition of Panacea, in Berkeley's *First Letter to Thomas Prior*, sect. 12. It was Berkeley's opinion, that tar-water may even be a Panacea or universal medicine, that chiefly excited the faculty against *Siris*.

[3] Cloyne.

73. They who know the great virtues of common soap, whose coarse lixivial salts are the product of culinary fire, will not think it incredible that virtues of mighty force and extent should be found in a fine acid soap (sect. 58), the salts and oil whereof are a most elaborate product of nature and the solar light.

74. It is certain tar-water warms, and therefore some may perhaps still think it cannot cool. The more effectually to remove this prejudice, let it be farther considered that as, on the one hand, opposite causes do sometimes produce the same effect, for instance, heat by rarefaction and cold by condensation do both increase the air's elasticity; so, on the other hand, the same cause shall sometimes produce opposite effects: heat for instance [[1]thins, and again heat coagulates] the blood. It is not therefore strange, that tar-water should warm one habit and cool another, have one good effect on a cold constitution, and another good effect on an inflamed one; nor, if this be so, that it should cure opposite disorders. All which justifies to reason what I have often found true in fact. The salts, the spirits, the heat of tar-water are of a temperature congenial to the constitution of a man, which receives from it a kindly warmth, but no inflaming heat. It was remarkable that two children in my neighbourhood, being in a course of tar-water, upon an intermission of it, never failed to have their issues inflamed by a humour much more hot and sharp than at other times. But its great use in the small-pox, pleurisies, and fevers is a sufficient proof that tar-water is not of an inflaming nature.

75. I have dwelt the longer on this head, because some gentlemen of the faculty have thought fit to declare that tar-water must inflame, and that they would never visit any patient in a fever who had been a drinker of it[2]. But I will venture to affirm, that it is so far from increasing a feverish inflammation, that it is on the contrary a most ready means to allay and extinguish it. It is of admirable use in fevers, being at the same time the surest, safest and most effectual, both paregoric and cordial: for the truth of which I appeal to any person's experience who shall

[1] 'In one degree thins, and in another coagulates'—in first edition.
[2] Cf. sect. 7.

take a large draught of it milk warm in the paroxysm of a fever, even when plain water or herb-teas shall be found to have little or no effect. To me it seems that its singular and surprising use in fevers of all kinds, were there nothing else, would be alone sufficient to recommend it to the public.

76. The best physicians make the idea of a fever to consist in a too great velocity of the heart's motion, and too great resistance at the capillaries. Tar-water, as it softens and gently stimulates those nice vessels, helps to propel their contents, and so contributes to remove the latter part of the disorder. And for the former, the irritating acrimony which accelerates the motion of the heart is diluted by watery, corrected by acid, and softened by balsamic remedies, all which intentions are answered by this aqueous, acid, balsamic medicine. Besides, the viscid juices coagulated by the febrile heat are resolved by tar-water as a soap, and not too far resolved, as it is a gentle acid soap; to which we may add, that the peccant humours and salts are carried off by its diaphoretic and diuretic qualities.

77. I found all this confirmed by my own experience in the late sickly season of the year one thousand seven hundred and forty-one, having had twenty-five fevers in my own family cured by this medicinal water, drunk copiously[1]. The same method was practised on several of my poor neighbours with equal success. It suddenly calmed the feverish anxieties, and seemed every glass to refresh, and infuse life and spirit into the patient. At first some of these patients had been vomited, but afterwards I found that without vomiting, bleeding, blistering, or any other evacuation or medicine whatever, very bad fevers could be cured by the sole drinking of tar-water, milk warm, and in good quantity, perhaps a large glass every hour [[2] or oftener] taken in bed. And it was remarkable that such as were cured by this comfortable cordial recovered health and spirits at once, while those who had been cured by evacuations often languished long, even after the fever had left them, before they could recover of their medicines and regain their strength.

[1] Cf. Berkeley's letters to Thomas Prior, in February and May, 1741, in my *Life and Letters of Berkeley*.

[2] Not in the early editions.

78. In peripneumonies and pleurisies I have observed tar-water to be excellent, having known some pleuritic persons cured without bleeding, by a blister early applied to the stitch, and the copious drinking of tar-water, four or five quarts, or even more in four-and-twenty hours. And I do recommend it to farther trial, whether in all cases of a pleurisy, one moderate bleeding, a blister on the spot, and plenty of tepid tar-water may not suffice, without those repeated and immoderate bleedings, the bad effects of which are perhaps never got over. I do even suspect that a pleuritic patient betaking himself to bed betimes, and drinking very copiously of tar-water, may be cured by that alone, without bleeding, blistering, or any other medicine whatsoever: certainly I have found this succeed at a glass every half hour.

79. I have known a bloody flux of long continuance, after divers medicines had been tried in vain, cured by tar-water[1]. But that which I take to be the most speedy and effectual remedy in a bloody flux is a clyster of an ounce of common brown resin dissolved over a fire in two ounces of oil, and added to a pint of broth, which not long since I had frequent occasion of trying when that distemper was epidemical. Nor can I say that any to whom I advised it miscarried. This experiment I was led to make by the opinion I had of tar as a balsamic: and resin is only tar inspissated.

80. Nothing that I know corroborates the stomach so much as tar-water (sect. 68). Whence it follows, that it must be of singular use to persons afflicted with the gout. And, from what I have observed in five or six instances, I do verily believe it the best and safest medicine either to prevent the gout, or so to strengthen nature against the fit, as to drive it from the vitals. Dr. Sydenham, in his *Treatise of the Gout*[2], declares that whoever finds a medicine the most efficacious for strengthening digestion will do more service in the cure of that and other chronical distempers than he can even form a notion of. And I leave

[1] Cf. letter to Prior, Feb. 8, 1741.

[2] *Tractatus de Podagra* (see sect. 29, 40), by Sydenham (1624–1689), the friend of Locke and Boyle, and the greatest English physician of the seventeenth century. He was himself a martyr to gout.

it to trial, whether tar-water be not that medicine, as I myself am persuaded it is, by all the experiments I could make. But in all trials I would recommend discretion; for instance, a man with the gout in his stomach ought not to drink cold tar-water. This Essay leaves room for future experiment in every part of it, not pretending to be a complete treatise.

81. It is evident to sense that blood, urine, and other animal juices, being let to stand, soon contract a great acrimony. Juices, therefore, from a bad digestion retained, and stagnating in the body, grow sharp and putrid. Hence a fermenting heat, the immediate cause of the gout. The curing this by cooling medicines, as they would increase the antecedent cause, must be a vain attempt. On the other hand, spices and spirituous liquors, while they contribute to remove the antecedent cause or bad digestion, would, by inflaming the blood, increase the proximate or immediate cause of the gout, to wit, the fermenting heat. The scope therefore must be, to find a medicine that shall corroborate but not inflame. Bitter herbs are recommended; but they are weak in comparison of tar-water.

82. The great force of tar-water to correct the acrimony of the blood appears in nothing more than in the cure of a gangrene from an internal cause; which was performed on a servant of my own, by prescribing the copious and constant use of tar-water for a few weeks. From my representing tar-water as good for so many things, some perhaps may conclude it is good for nothing. But charity obligeth me to say what I know, and what I think, howsoever it may be taken. Men may censure and object as they please, but I appeal to time and experiment. Effects misimputed, cases wrong told, circumstances overlooked, perhaps, too, prejudices and partialities against truth, may for a time prevail, and keep her at the bottom of her well, from whence nevertheless she emergeth sooner or later, and strikes the eyes of all those who do not keep them shut [1].

83. Boerhaave [2] thinks a specific may be found for that

[1] Cf. sect. 367-68.

[2] See his *Aphorismi de Cognoscendis et Curandis Morbis* (1708), aph. 1390, 1391; also his *Praxis Medica* (1728)—'De Variolis,' pp. 297-320. Cf. Berkeley's *Further Thoughts on Tar-water.*

peculiar venom which infects the blood in the small-pox, and that the prospect of so great a public benefit should stir up men to search for it. Its wonderful success in preventing and mitigating that distemper (sect. 2, 3) would incline one to suspect that tar-water is such a specific [[1] especially since I have found it of sovereign use as well during the small-pox as before it]. Some think an erysipelas and the plague differ only in degree. If so, tar-water should be useful in the plague, for I have known it cure an erysipelas.

84. Tar-water, as cleansing, healing, and balsamic, is good in all disorders of the urinary passages, whether obstructed or ulcerated. Dr. Lister[2] supposeth, indeed, that turpentines act by a caustic quality, which irritates the coats of the urinary ducts to expel sand or gravel. But it should seem this expelling diuretic virtue consisted rather in the salts than the resin, and consequently resides in the tar-water, gently stimulating by its salts, without the dangerous force of a caustic. The violent operation of ipecacuanha lies in its resin, but the saline extract is a gentle purge and diuretic, by the stimulus of its salts.

85. That which acts as a mild cordial (sect. 66), neither hurting the capillary vessels as a caustic, nor affecting the nerves, nor coagulating the juices, must in all cases be a friend to nature, and assist the *vis vitæ* in its struggle against all kinds of contagion. And from what I have observed, tar-water appears to me a useful preservative in all epidemical disorders, and against all other infection whatsoever, as well as that of the small-pox. What effects the *animi pathemata* have in human maladies is well known, and consequently the general benefit of such a cardiac [[3] may be reasonably supposed].

86. [4] As the body is said to clothe the soul, so the nerves

[1] Added in second edition.

[2] Martin Lister (1638–1712), an English physician, frequent contributor to the *Philos. Trans.*, and author of works in natural history and anatomy of repute in their day. His *Journey to Paris* (1698) was parodied by Dr. King in his *Journey to London*. Dr. Lister was a benefactor to the Ashmolean Museum.

[3] 'Cannot be doubted'—in first edition.

[4] In sect. 86–119 we have an account of the utility of tar-water in nervous diseases, indigestion,

may be said to constitute her inner garment[1]. And, as the soul animates the whole, what nearly touches the soul relates to all. Therefore the asperity of tartarous salts, and the fiery acrimony of alkaline salts, irritating and wounding the nerves, produce nascent passions and anxieties in the soul; which both aggravate distempers, and render men's lives restless and wretched, even when they are afflicted with no apparent distemper. This is the latent spring of much woe, spleen, and *tædium vitæ*. Small imperceptible irritations of the minutest fibres or filaments, caused by the pungent salts of wines and sauces, do so shake and disturb the microcosms of high livers, as often to raise tempests in courts and senates. Whereas the gentle vibrations that are raised in the nerves, by a fine subtle acid, sheathed in a smooth volatile oil (sect. 59, 61), softly stimulating and bracing the nervous vessels and fibres, promote a due circulation and secretion of the animal juices, and create a calm satisfied sense of health. And, accordingly, I have often known tar-water procure sleep and compose the spirits in cruel vigils, occasioned either by sickness or by too intense application of mind.

87. In diseases sometimes accidents happen from without by mismanagement, sometimes latent causes operate within, jointly with the specific taint or peculiar cause of the malady. The causes of distempers are often complicated, and there may be something in the idiosyncrasy of the patient that puzzles the physician. It may therefore be presumed that no medicine is infallible, not even in any one disorder. But, as tar-water possesseth the virtues of fortifying the stomach, as well as purifying and invigorating the blood, beyond any medicine that I know, it may be presumed of great and general efficacy in all those numerous illnesses which take their rise from foul or vapid blood, or from a bad digestion. The animal spirits are elaborated from the blood. Such therefore as the blood is, such will be the animal spirits, more or less, weaker or stronger. This sheweth the usefulness of tar-water in all hysteric and hypochondriac cases: which, together with

and scurvy, with an eloquent announcement of its advantages to the studious.

[1] Elsewhere Berkeley speaks of the body, including the nerves, as contained in percipient mind. The two modes of statement are easily reconcileable.

the maladies from indigestion, comprise almost the whole tribe of chronical diseases.

88. The *scurvy* may be reckoned in these climates a universal malady, as people in general are subject to it, and as it mixes more or less in almost all diseases. Whether this proceeds from want of elasticity in our air, upon which the tone of the vessels depends, and upon that the several secretions; or whether it proceeds from the moisture of our climate, or the grossness of our food, or the salts in our atmosphere, or from all these together—thus much at least seems not absurd to suppose, that as physicians in Spain and Italy are apt to suspect the venereal taint to be a latent principle, and bear a part in every illness, so far, as good reason, the scurvy should be considered by our physicians as having some share in most disorders and constitutions that fall in their way. It is certain our perspiration is not so free as in clearer air and warmer climates. Perspirable humours not discharged will stagnate and putrefy. A diet of animal food will be apt to render the juices of our bodies alkalescent. Hence ichorous and corrosive humours and many disorders. Moist air makes viscid blood; and saline air inflames this viscid blood. Hence broken capillaries, extravasated blood, spots, and ulcers, and other scorbutic symptoms. The body of a man attracts and imbibes the moisture and salts of the air and whatever floats in the atmosphere, which as it is common to all, so it affects all more or less.

89. Doctor Musgrave[1] thinks the Devonshire scurvy a relic of the leprosy, and that it is not owing to the qualities of the air. But, as these insulars in general live in a gross saline air, and their vessels being less elastic are consequently less able to subdue and cast off what their bodies as sponges draw in, one would be tempted to suspect the air not a little concerned, especially in such a situation as that of Devonshire. In all these British islands we enjoy a great mediocrity of climate; the effect whereof is, that we have neither heat enough to exalt and

[1] William Musgrave (1655-1721), an eminent physician, Secretary to the Royal Society. He settled at Exeter in 1621, and practised there for thirty years with high reputation. See Munk's *Roll of the Royal College of Physicians of London* (pp. 446-448) for an interesting account of Musgrave and his works.

dissipate the gross vapours, as in Italy, nor cold enough to condense and precipitate them, as in Sweden. So they are left floating in the air, which we constantly breathe, and imbibe through the whole surface of our bodies. And this, together with exhalations from coal fires, and the various fossils wherein we abound, doth greatly contribute to render us scorbutic and hypochondriac.

90. There are some who derive all diseases from the scurvy, which indeed must be allowed to create or mimic most other maladies. Boerhaave[1] tells us, it produceth pleuritic colic, nephritic, hepatic pains, various fevers, hot, malignant, intermitting dysenteries, faintings, anxieties, dropsies, consumptions, convulsions, palsies, fluxes of blood. In a word, it may be said to contain the seeds and origin of almost all distempers. Insomuch that a medicine which cures all sorts of scurvy may be presumed good for most maladies.

91. The scurvy doth not only in variety of symptoms imitate most distempers, but also, when come to a height, in degree of virulence equal the most malignant. Of this we have a remarkable proof in that horrible description of the scorbutic patients in the hospitals of Paris, given by Monsieur Poupart[2], in the *Memoirs of the Royal Academy of Sciences*, for the year 1699. That author thinks he saw some resemblance in it to the plague of Athens[3]. It is hard to imagine anything more dreadful than the case of those men, rotting alive by scurvy in its supreme degree. To obviate such putrefaction, I believe the most effectual method would be, to embalm (if one may so say) the living body with tar-water copiously drunk; and this belief is not without experience.

92. It is the received opinion that the animal salts of a sound body are of a neutral, bland, and benign nature: that is, the salts in the juices past the *primæ viæ* are neither acid or alkaline, having been subdued by the constitution,

[1] *Praxis Medica*—'De Scorbuto,' tom. V. pp. 101–17.

[2] Francis Poupart (1661–1709), the French anatomist, and member of the Academy, was a frequent contributor, especially on comparative anatomy, to the *Journal des Savans*, and the *Mémoires de l'Académie*. The paper referred to—*Étranges Effets du Scorbut arrivez à Paris en* 1699—appeared in the *Mémoires* in November of that year. It is also contained in the *Philos. Trans.* No. 318.

[3] Lucretius, *De Rerum Nat.* VI. 1136–1284.

and changed into a third nature. Where the constitution wants force to do this, the aliment is not duly assimilated: and, so far as the salts retain their pristine qualities, sickly symptoms ensue, acids and alkalies not perfectly subdued producing weak ferments in the juices. Hence scurvy, cachexy, and a long train of ills.

93. A cachexy or ill habit is much of the same kind with the scurvy, proceeds from the same causes, and is attended with like symptoms, which are so manifold and various, that the scurvy may well be looked on as a general cachexy, infecting the whole habit, and vitiating all the digestions. Some have reckoned as many sorts of the scurvy as there are taints of the blood. Others have supposed it a collection of all illnesses together. Some suppose it an accumulation of several diseases *in fieri*. Others take it for an assemblage of the relics of old distempers.

94. But thus much is certain, the cure of the scurvy is no more to be attempted by strongly active medicines, than (to use the similitude of an ingenious writer) a thorn in the flesh, or pitch on silk, to be removed by force. The viscid humour must be gently resolved and diluted, the tone of the vessels recovered by a moderate stimulation, and the tender fibres and capillary vessels gradually cleared from the concreted stuff that adheres and obstructs them. All which is in the aptest manner performed by a watery diluent, containing a fine vegetable soap. And although a complete cure by alteratives, operating on the small capillaries, and by insensible discharges, must require length of time, yet the good effect of this medicine on cachectic and scorbutic persons is soon perceived, by the change it produceth in their pale discoloured looks, giving a florid healthy countenance in less time than perhaps any other medicine.

95. It is supposed by physicians that the immediate cause of the scurvy lies in the blood, the fibrous part of which is too thick and the serum too thin and sharp; and that hence ariseth the great difficulty in the cure, because in the correcting of one part regard must be had to the other. It is well known how extremely difficult it is to cure an inveterate scurvy: how many scorbutic patients have grown worse by an injudicious course of evacuations: how many are even rendered incurable by the treatment of

inconsiderate physicians; and how difficult, tedious, and uncertain, the cure is in the hands even of the best, who are obliged to use such variety and change of medicines, in the different stages of that malady: which nevertheless may be cured (if I may judge by what I have experienced) by the sole, regular, constant, copious use of tar-water.

96. Tar-water moderately inspissates with its balsamic virtue, and renders mild the thin and sharp part of the blood, the same as a soapy medicine dissolves the grumous concretions of the fibrous part. As a balsam it destroys the ulcerous acrimony of the humours, and as a deobstruent it opens and cleans the vessels, restores their tone, and strengthens the digestion, whose defects are the principal cause of scurvy and cachexy.

97. In the cure of the scurvy the principal aim is to subdue the acrimony of the blood and juices. But, as this acrimony proceeds from different causes, or even opposite, as acid and alkaline, what is good in one sort of scurvy proves dangerous or even mortal in another. It is well known that hot antiscorbutics, where the juices of the body are alkalescent, increase the disease. And sour fruits and vegetables produce a like effect in the scurvy, caused by an acid acrimony. Hence fatal blunders are committed by unwary practitioners, who, not distinguishing the nature of the disease, do frequently aggravate instead of curing it. If I may trust what trials I have been able to make, this water is good in the several kinds of scurvy, acid, alkaline, and muriatic, and I believe it the only medicine that cures them all without doing hurt to any. As it contains a volatile acid (sect. 7) with a fine volatile oil, why may not a medicine cool in one part and warm in another be a remedy to either extreme (sect. 72)? I have observed it to produce a kindly genial warmth without heat, a thing to be aimed at in all sorts of scurvy. Besides, the balsam in tar-water sheathes all scorbutic salts alike: and its great virtues as a digester and deobstruent are of general use in all scorbutic, and I may add, in all chronical cases whatsoever.

98. I cannot be sure that I have tried it in a scrofulous case, though I have tried it successfully in one that I suspected to be so. And I apprehend it would be very

serviceable in such disorders. For although Dr. Gibbs in his treatise on the *King's Evil*[1] derives that disease from a coagulating acid, which is also agreeable to the opinion of some other physicians, and although tar-water contain an acid, yet, as it is a soap (sect. 58), it resolves instead of coagulating the juices of the body.

99. For hysterical and hypochondriacal disorders so frequent among us, it is commonly supposed that all acids are bad. But I will venture to except the acid soap of tar-water, having found by my own experience and that of many others, that it raises the spirits, and is an excellent anti-hysteric, nor less innocent than potent, which cannot be said of those others in common use, that often leave people worse than they found them.

100. In a high degree of scurvy a mercurial salivation is looked on by many as the only cure; which, by the vehement shock it gives the whole frame, and the sensible secretion it produceth, may be thought more adequate to such an effect. But the disorder occasioned by that violent process, it is to be feared, may never be got over. The immediate danger, the frequent bad effects, the extreme trouble and nice care attending such a course, do very deservedly make people afraid of it. And though the sensible secretion therein be so great, yet in a longer tract of time the use of tar-water may produce as great a discharge of scorbutic salts by urine and by perspiration—the effect of which last, though not so sensible, may yet be greater than that of salivation; especially if it be true that in common life insensible perspiration is to nutrition, and all sensible excretions, as five to three.

101. Many hysteric and scorbutic ailments, many taints contracted by themselves, or inherited from their ancestors, afflict the people of condition in these islands, often rendering them, upon the whole, much more unhappy than those whom poverty and labour have ranked in the lowest lot of life, which ailments might be safely removed or relieved by the sole use of tar-water; and those lives which seem hardly worth living for bad appetite, low spirits, restless nights, wasting pains and anxieties, be rendered easy and comfortable.

[1] *Observations of Various Cases of Scrophulous Disorder, commonly called the King's Evil.* (London, 1702.)

102. As the nerves are instruments of sensation, it follows that spasms in the nerves may produce all symptoms, and therefore a disorder in the nervous system shall imitate all distempers, and occasion, in appearance, an asthma for instance, a pleurisy, or a fit of the stone. Now, whatever is good for the nerves in general is good against all such symptoms. But tar-water, as it includes in an eminent degree the virtues of warm gums and resins, is of great use for comforting and strengthening the nerves (sect. 86), curing twitches in the nervous fibres, cramps also, and numbness in the limbs, removing anxieties, and promoting sleep: in all which cases I have known it very successful.

103. This safe and cheap medicine suits all circumstances and all constitutions, operating easily, curing without disturbing, raising the spirits without depressing them, a circumstance that deserves repeated attention: especially in these climates, where strong liquors so fatally and so frequently produce those very distresses they are designed to remedy; and, if I am not misinformed, even among the ladies themselves, who are truly much to be pitied[1]. Their condition of life makes them a prey to imaginary woes, which never fail to grow up in minds unexercised and unemployed. To get rid of these, it is said, there are who betake themselves to distilled spirits. And it is not improbable they are led gradually to the use of those poisons by a certain complaisant pharmacy, too much used in the modern practice, palsy drops, poppy cordial, plague water, and such like, which being in truth nothing but drams disguised, yet, coming from the apothecaries, are considered only as medicines.

104. The soul of man was supposed by many ancient sages to be thrust into the human body as into a prison, for punishment of past offences. But the worst prison is the body of an indolent epicure, whose blood is inflamed by fermented liquors (sect. 66) and high sauces, or rendered putrid, sharp, and corrosive, by a stagnation of the animal juices through sloth and indolence; whose membranes are irritated by pungent salts; whose mind is agitated by painful oscillations of the nervous system (sect. 86), and

[1] Note what is said of the prevalence, causes, and stringent cure of drunkenness, in sect. 103-109.

whose nerves are mutually affected by the irregular passions of his mind. This ferment in the animal economy darkens and confounds the intellect. It produceth vain terrors and vain conceits, and stimulates the soul with mad desires, which, not being natural, nothing in nature can satisfy. No wonder, therefore, there are so many fine persons of both sexes, shining themselves, and shone on by fortune, who are inwardly miserable and sick of life.

105. The hardness of stubbed vulgar constitutions renders them insensible of a thousand things that fret and gall those delicate people, who, as if their skin was peeled off, feel to the quick everything that touches them. The remedy for this exquisite and painful sensibility is commonly sought from fermented, perhaps from distilled, liquors, which render many lives wretched that would otherwise have been only ridiculous. The tender nerves and low spirits of such poor creatures would be much relieved by the use of tar-water, which might prolong and cheer their lives. I do therefore recommend to them the use of a cordial, not only safe and innocent, but giving health and spirits as surely as other cordials destroy them.

106. I do verily think there is not any other medicine whatsoever so effectual to restore a crazy constitution, and cheer a dreary mind, or so likely to subvert that gloomy empire of the spleen (sect. 103) which tyrannizeth over the better sort (as they are called) of these free nations; and maketh them, in spite of their liberty and property, more wretched slaves than even the subjects of absolute power, who breathe clear air in a sunny climate[1]. While men of low degree often enjoy a tranquillity and content that no advantage of birth or fortune can equal. Such, indeed, was the case while the rich alone could afford to be debauched; but when even beggars became debauchees, the case was altered.

107. The public virtue and spirit of the British legislature never shewed itself more conspicuous in any act than in that for suppressing the immoderate use of [[2]distilled spirits] among the people, whose strength and numbers constitute the true wealth of a nation: though evasive arts

[1] Cf. *Alciphron*, Dial. II. sect. 17.

[2] 'spirituous liquors'—in the early editions.

will, it is feared, prevail so long as distilled spirits of any kind are allowed, the character of Englishmen in general being that of Brutus, *Quicquid vult, valde vult.* But why should such a canker be tolerated in the vitals of a state, under any pretence or in any shape whatsoever? Better by far the whole present set of distillers were pensioners of the public, and their trade abolished by law; since all the benefit thereof put together would not balance the hundredth part of its mischief.

108. To prove the destructive effects of such spirits with regard both to the human species and individuals, we need not go so far as our Colonies, or the savage natives of America. Plain proof may be had nearer home. For, albeit there is in every town or district throughout England some tough dram-drinker, set up as the devil's decoy, to draw in proselytes; yet the ruined health and morals, and the beggary of such numbers, evidently shew that we need no other enemy to complete our destruction, than this cheap luxury at the lower end of the state, and that a nation lighted up at both ends must soon be consumed.

109. It is much to be lamented that our insulars, who act and think so much for themselves, should yet, from grossness of air and diet, grow stupid or dote sooner than other people, who by virtue of elastic air, water drinking, and light food, preserve their faculties to extreme old age; an advantage which may perhaps be approached, if not equalled, even in these regions, by tar-water, temperance, and early hours. The last is a sure addition to life, not only in regard of time, which, being taken from sleep, the image of death[1], is added to the waking hours, but also in regard of longevity and duration in the vulgar sense. I may say too in regard of spirit and vivacity, which, within the same compass of duration, may truly and properly be affirmed to add to man's life: it being manifest, that one man, by a brisker motion of his spirits and succession of his ideas, shall live more in one hour than another in two: and that the quantity of life is to be

[1] So Shelley in *Queen Mab*—

'How wonderful is Death,
Death and his brother Sleep!
One, pale as yonder waning moon,
With lips of lurid blue;
The other, rosy as the morn
When throned on ocean's wave,
It blushes o'er the world:
Yet both so passing wonderful!'

estimated, not merely from the duration, but also from the intenseness of living. Which intense living, or, if I may so say, lively life, is not more promoted by early hours as a regimen, than by tar-water as a cordial; which acts, not only as a slow medicine, but hath also an immediate and cheerful effect on the spirits (sect. 66).

110. It must be owned, the light attracted, secreted, and detained in tar (sect. 8, 29, 40), and afterwards drawn off in its finest balsamic particles, by the gentle menstruum of cold water, is not a violent and sudden medicine, always to produce its effect at once (such, by irritating, often do more mischief than good), but a safe and mild alterative, which penetrates the whole system, opens, heals, and strengthens the remote vessels, alters and propels their contents, and enters the minutest capillaries, and cannot therefore, otherwise than by degrees and in time, work a radical cure of chronic distempers. It gives nevertheless speedy relief in most cases, as I have found by myself and many others. I have been surprised to see persons fallen away and languishing under a bad digestion, after a few weeks recover a good stomach, and with it flesh and strength, so as to seem renewed, by the drinking of tar-water. The strength and quantity of this water to be taken by each individual person is best determined from experience. And as for the time of taking, I never knew any evil ensue from its being continued ever so long; but, on the contrary, many and great advantages, which sometimes would not perhaps begin to shew themselves till it had been taken two or three months.

111. We learn from Pliny that in the first ferment of new wine or *mustum*, the ancients were wont to sprinkle it with powdered resin, which gave it a certain sprightliness, *quædam saporis acumina*. This was esteemed a great improver of its odour and taste, and was, I doubt not, of its salubrity also. The brown old resin, that is to say hardened tar, as being more easily pulverized and sifted, was most in request for this purpose. They used likewise to season their wine vessels with pitch or resin. And I make no doubt that if our vintners would contrive to medicate their wines with the same ingredients, they might improve and preserve them with less trouble and expense to themselves, and less danger to others. He that would

know more particulars of this matter may consult Pliny and Columella[1]. I shall only add, that I doubt not a similar improvement may be made of malt liquor.

112. The ῥητίνη of Theophrastus and *resina* of Pliny are sometimes used in a general sense, to signify all sorts of oily viscid exudations from plants or trees. The crude watery juice that riseth early in the spring is gradually ripened and inspissated by the solar heat, becoming in orderly succession with the seasons an oil, a balsam, and at last a resin. And it is observed by chemists that turpentine dissolved over a gentle fire is, by the constant operation of heat, successively transformed into oil, balsam, pitch, and hard friable resin, which will incorporate with oil or rectified spirit, but not with water.

113. Sir John Floyer[2] remarks, that we want a method for the use of turpentine: and again, he who shall hit, saith he, on the pleasantest method of giving turpentine will do great cures in the gout, stone, catarrhs, dropsies, and cold scurvies, rheumatisms, ulcers, and obstructions of the glands. Lastly, he subjoins, that, for the use of altering and amending the juices and fibres, it must be given frequently, and in such small quantities at a time, and in so commodious a manner, as will agree best with the stomach (sect. 9), stay longest in the body, and not purge itself off; for large doses (saith he) go through too quick, and besides offend the head. Now, the infusion of tar or turpentine in cold water seems to supply the very method that was wanted, as it leaves the more unctuous and gross parts behind (sect. 47), which might offend the stomach, intestines, and head; and, as it may be easily taken, and as often, and in such quantity and such degree of strength, as suits the case of the patient. Nor should it seem that the fine spirit and volatile oil, obtained by infusion of tar (sect. 7, 42, 58), is inferior to that of turpentine, to which it superadds the virtue of wood soot,

[1] See Pliny, *Hist. Nat.* Lib. XIV. c. 25; and Columella, *De Re Rustica*, Lib. XII. c. 23, 24.

[2] Sir John Floyer (1649–1734), an eminent English physician. See his *Touchstone of Medicines* (1687), Pt. III. He brought the cold bath into fashion in his generation, and 'rode his hobby so hard as to attribute the prevalence of rickets in England, at the time he wrote (about 1700), to the abandonment of total immersion in baptism.' See Macpherson's *Baths and Wells of Europe*, p. 53.

which is known to be very great with respect to the head and nerves; and this appears evident from the manner of obtaining tar (sect. 13). And as the fine volatile parts of tar or turpentine are drawn off by infusion in cold water, and easily conveyed throughout the whole system of the human body; so it should seem the same method may be used with all sorts of balsams or resins whatsoever, as the readiest, easiest, and most inoffensive, as well as in many cases the most effectual way of obtaining and imparting their virtues.

114. After having said so much of the uses of tar, I must further add that, being rubbed on them, it is an excellent preservative of the teeth and gums: [[1]that it sweetens the breath, and] that it clears and strengthens the voice. And, as its effects are various and useful, so there is nothing to be feared from the operation of an alterative so mild and friendly to nature. It was a wise maxim of certain ancient philosophers, that diseases ought not to be irritated by medicines (sect. 103). But no medicine disturbs the animal economy less than this, which, if I may trust my own experience, never produces any disorder in a patient when rightly taken.

115. I knew indeed a person who took a large glass of tar-water just before breakfast, which gave him an invincible nausea and disgust, although he had before received the greatest benefit from it. But, if the tar-water be taken and made in the manner prescribed at the beginning of this Essay, it will, if I mistake not, have enough of the salt to be useful, and little enough of the oil to be inoffensive. [[2]I mean my own manner of making it, and not the American[3], which makes it sometimes too strong and sometimes too weak; which tar-water, however it might serve as there used, merely for a preservative against the small-pox, yet may not be fit to use in all those various cases wherein I have found tar-water so successful.] Persons more delicate than ordinary may render it palatable, by mixing a drop of the chemical oil of nutmegs, or a spoonful of mountain-wine in each glass. It may not be amiss to observe that I have known some, whose nice stomachs could not bear it in the morning,

[1] Added in the second edition. [2] Added in the second edition.
[3] Cf. sect. 1.

take it at night going to bed without any inconvenience [[1] and that with some it agrees best warm, with others cold]. [[2] For outward washes and fomentations, it may be made stronger, as by pouring on warm water; also for brute beasts, as horses, in whose disorders I have found it very useful, I believe more so than that bituminous substance called Barbadoes tar.]

116. In very dangerous and acute cases much may be taken and often; as far as the stomach can bear. But in chronical cases, about half a pint night and morning may suffice [[3] or, in case so large a dose should prove disagreeable, half the quantity may be taken at four times, to wit, in the morning early, at night going to bed, and about two hours after dinner and breakfast]. A medicine of so great virtue in so many different disorders, and especially in that grand enemy the fever, must needs be a benefit to mankind in general. There are nevertheless three sorts of people to whom I would peculiarly recommend it: seafaring persons, ladies, and men of studious and sedentary lives.

117. To sailors and all seafaring persons, who are subject to scorbutic disorders and putrid fevers, especially in long southern voyages, I am persuaded this tar-water would be beneficial. And this may deserve particular notice in the present course of marine expeditions, when so many of our countrymen have perished by such distempers, contracted at sea and in foreign climates. Which, it is probable, might have been prevented by the copious use of tar-water.

118. This same water will also give charitable relief to the ladies (sect. 103), who often want it more than the parish poor; being many of them never able to make a good meal, and sitting pale, puny, and forbidden like ghosts, at their own table, victims of vapours and indigestion.

119. Studious persons also, pent up in narrow holes, breathing bad air, and stooping over their books, are much to be pitied. As they are debarred the free use of air and exercise, this I will venture to recommend as the

[1] Omitted in the later editions. [2] Added in the later editions.
[3] Added in the later editions.

best succedaneum to both. Though it were to be wished that modern scholars would, like the ancients, meditate and converse more in walks and gardens and open air, which upon the whole would perhaps be no hinderance to their learning, and a great advantage to their health. My own sedentary course of life had long since thrown me into an ill habit, attended with many ailments, particularly a nervous colic, which rendered my life a burthen, and the more so, because my pains were exasperated by exercise. But, since the use of tar-water, I find, though not a perfect recovery from my old and rooted illness, yet such a gradual return of health and ease, that I esteem my having taken this medicine the greatest of all temporal blessings, and am convinced that, under Providence, I owe my life to it.

120. In the distilling of turpentine and other balsams by a gentle heat, it hath been observed that there riseth first an acid spirit (sect. 7) that will mix with water; which spirit, except the fire be very gentle, is lost[1]. This grateful acid spirit that first comes over is, as a learned chemist and physician[2] informs us, highly refrigeratory, diuretic, sudorific, balsamic, or preservative from putrefaction, excellent in nephritic cases, and for quenching thirst—all which virtues are contained in the cold infusion which draws forth from tar only its fine flower or quintessence, if I may so say, or the native vegetable spirit, together with a little volatile oil.

121. The distinguishing principle of all vegetables—that whereon their peculiar smell, taste, and specific properties depend—seems to be some extremely fine and subtle spirit, whose immediate vehicle is an exceeding thin volatile oil; which is itself detained in a grosser and more viscid resin or balsam, lodged in proper cells in the bark and seeds, and most abounding in autumn or winter, after the crude

[1] Having, in the preceding sections, inferred the catholic efficacy of tar-water, Berkeley, in sect. 120–230, speculates on the physical causes of its wonderful medicinal properties. The speculation carries him into the science of Acids and Salts (sect. 120–156); and of Air, that common seminary of all life-giving elements (sect. 137–151); at last to Pure Æther, Light, or Vital Fire (sect. 152–230) —according to him, the *ultimate instrumental cause* in nature.

[2] Boerhaave.

juices have been thoroughly concocted, ripened, and impregnated with solar light. The spirit itself is by some supposed to be an oil highly subtilized, so as to mix with water. But such volatile oil is not the spirit, but only its vehicle. Since aromatic oils being long exposed to air will lose their specific smell and taste, which fly off with the spirit or vegetable salt, without any sensible diminution of the oil.

122. Those volatile salts that are set free and raised by a gentle heat may justly be supposed essential (sect. 8), and to have pre-existed in the vegetable; whereas the lixivial fixed salts, obtained by the incineration of the subject, whose natural constituent parts have been altered or destroyed by the extreme force of fire, are, by later chemists, upon very good grounds, supposed not to have pre-existed therein—all such salts appearing, from the experiments of Signor Redi[1], not to preserve the virtues of the respective vegetable subjects; and to be alike purgative and in an equal degree, whatsoever may be the shape of their points, whether sharp or obtuse. But, although fixed or lixivial salts may not contain the original properties of the subject, yet volatile salts, raised by a slight heat from vegetables, are allowed to preserve their native virtues: and such salts are readily imbibed by water.

123. The most volatile of the salts, and the most attenuated part of the oil may be supposed the first and readiest to impregnate a cold infusion (sect. 1, 7). And this will assist us to account for the virtues of tar-water. That volatile acid in vegetables, which resists putrefaction and is their great preservative, is detained in a subtle oil, miscible with water; which oil is itself imprisoned in the resin or grosser part of the tar, from which it is easily set free and obtained pure by cold water.

124. The mild native acids are observed more kindly to work upon, and more thoroughly to dissolve metallic bodies, than the strongest acid spirits produced by a vehement fire; and it may be suspected they have the same advantage as a medicine. And, as no acid, by the

[1] Francesco Redi (1626–1697), an Italian naturalist and poet, a member of the Della Crusca. See his *Experimenta Naturalia* (1675). His collected works occupy seven volumes.

observation of some of the best chemists, can be obtained from the substance of animals thoroughly assimilated, it should follow that the acids received into a healthy body must be quite subdued and changed by the vital powers: but it is easier to subdue and assimilate the gentler than the stronger acids (sect. 48).

125. I am very sensible that on such subjects arguments fall short of evidence: and that mine fall short even of what they might have been if I enjoyed better health, or those opportunities of a learned commerce from which I am cut off in this remote corner [1]. I shall nevertheless go on as I have begun, and proceed, by reason, by conjecture, and by authority, to cast the best light I can on the obscure paths that lie in my way.

126. Sir Isaac Newton [2], Boerhaave, and Homberg [3], are all agreed that the Acid is a fine subtle substance, pervading the whole terraqueous globe; which produceth divers kinds of bodies, as it is united to different subjects. [4] This, according to Homberg, is the pure salt, salt the principle, in itself similar and uniform, but never found alone. And although this principle be called the salt of the earth, yet it should seem it may more properly be called the salt of

[1] Berkeley's critics complained of neglect of 'negative instances,' or defective conceptionof inductive proof, in the experiments from which he inferred the *catholicity* of tar-water as a medicine.

[2] See Newton's tract of two pages, *De Natura Acidorum*, published apparently about 1692. It was followed by another equally brief, entitled *Cogitationes Variæ*, among which are suggestions on chemical subjects. Some of these reappear in the Queries at the end of his *Optics*. Those brief tracts contain nearly all that Newton published relating to chemistry.

[3] William Homberg (1652-1715), a French chemist, and first physician to the Duke of Orleans, born in Java. His writings consist of communications to the French Academy, whose *Mémoires* contain thirty-eight contributions (1699-1714) by Homberg. They relate almost exclusively to chemical questions, including the theory of acids and salts, and vegetable physiology. The *Histoire de l'Académie* (1715) contains an Eloge on Homberg. In Kopp's *Geschichte der Chemie* we have an account of him. Berkeley seems to have derived some of his chemical notions from Homberg, who was a good observer, but his inferences were often absurd. He held the old view of the *tria prima*—salt, sulphur, and mercury—of which, in different proportions, all material things were supposed to consist.

[4] Sect. 126-136 treat of the theory of acids, salts, alkalies, according to Newton, Boerhaave, and Homberg.

the air, since earth turned up and lying fallow receives it from the air. And it should seem that this is the great principle of vegetation, derived into the earth from all sorts of manures, as well as from the air. The acid is allowed to be the cause of fermentation in all fermented liquors. Why, therefore, may it not be supposed to ferment the earth, and to constitute that fine penetrating principle, which introduces and assimilates the food of plants, and is so fugitive as to escape all the filtrations and perquisitions of the most nice observers?

127. It is the doctrine of Sir Isaac Newton and Monsieur Homberg that, as the watery acid is that which renders salt soluble in water, so it is that same which joined to the earthy part makes it a salt. Let it therefore be considered that the organs of plants are tubes (sect. 30, 31, 35)—the filling, unfolding, and distending whereof, by liquors, doth constitute what is called the vegetation or growth of the plant. But earth itself is not soluble in water, so as to form one vegetable fluid therewith. Therefore the particles of earth must be joined with a watery acid; that is, they must become salts, in order to dissolve in water; that so, in the form of a vegetable juice, they may pass through the strainers and tubes of the root into the body of the plant, swelling and distending its parts and organs, that is, increasing its bulk. Therefore the vegetable matter of the earth is in effect earth changed into salt. And to render earth fertile is to cause many of its particles to assume a saline form.

128. Hence it is observed, there are more salts in the root than in the bark, more salts in vegetables during the spring than in the autumn or winter; the crude saline juices being in the summer months partly evaporated, and partly ripened, by the action and mixture of light. Hence also it appears why the dividing of earth, so as to enlarge its surface, whereby it may admit more acid from the air, is of such use in promoting vegetation: and why ashes, lime, and burnt clay are found so profitable manures, fire being in reality the acid, as is proved in the sequel (sect. 202). Marls also and shells are useful, forasmuch as those alkaline bodies attract the acid, and raise an effervescence with it, thereby promoting a fermentation in the glebe. The excrements of animals and putrid

vegetables do in like manner contribute to vegetation, by increasing the salts of the earth. And where fallows are well broken, and lie long to receive the acid of the air into all their parts; this alone will be sufficient to change many terrene particles into salts, and consequently render them soluble in water, and therefore a fit aliment for vegetables.

129. The acid, saith Homberg, is always joined to some sulphur, which determines it to this or that species, producing different salts, as it is the vegetable, bituminous, or metallic sulphur. Even the alkaline, whether volatile or lixivial salts, are supposed to be nothing but this same acid strictly detained by oil and earth, in spite of the extreme force of fire, which lodgeth in them, without being able to dislodge some remains of the acid.

130. Salts, according to Sir Isaac Newton, are dry earth and watery acid united by attraction, the acid rendering them soluble in water (sect. 127). He supposeth the watery acid to flow round the terrestrial part, as the ocean doth round the earth, being attracted thereby; and compares each particle of salt to a chaos, whereof the innermost part is hard and earthy, but the surface soft and watery. Whatever attracts and is attracted most strongly is an acid in his sense.

131. It seems impossible to determine the figures of particular salts. All acid solvents, together with the dissolved bodies, are apt to shoot into certain figures. And the figures in which the fossil salts crystallize have been supposed the proper natural shapes of them and their acids. But Homberg hath clearly shewed the contrary: forasmuch as the same acid dissolving different bodies assumes different shapes. Spirit of nitre, for instance, having dissolved copper, shoots into hexagonal crystals; the same having dissolved iron, shoots into irregular squares; and again, having dissolved silver, forms thin crystals of a triangular figure.

132. Homberg, nevertheless, holds in general, that acids are shaped like daggers, and alkalies like sheaths: and that, moving in the same liquor, the daggers run into the sheaths fitted to receive them with such violence as to raise that effervescence observed in the mixture of acids and alkalies. But it seems very difficult to conceive how or why the mere configuration of daggers and sheaths

floating in the same liquor should cause the former to rush with such vehemence, and direct their points so aptly into the latter, any more than a parcel of spigots and fossets floating together in the same water should rush one into the other.

133. It should seem rather that the vehement attraction which Sir Isaac Newton attributes to all acids, whereby he supposeth them to rush towards, penetrate, shake, and divide the most solid bodies, and to ferment the liquid of vegetables, could better account for this phenomenon. It is in this attraction that Sir Isaac placeth all their activity: and indeed it should seem, the figures of salts were not of such efficacy in producing their effects, as the strong active powers whereby they are agitated and do agitate other bodies. Especially if it be true (what was before remarked) that lixivious salts are alike purgative, whatever may be the shape of their angles, whether more or less acute or obtuse.

134. Sir Isaac Newton accounts for the watery acid's making earthy corpuscles soluble in water, by supposing the acid to be a mean between earth and water, its particles greater than those of water, and less than those of earth, and strongly to attract both. But perhaps there is no necessary reason for supposing the parts of the acid grosser than the parts of water, in order to produce this effect; may not this as well be accounted for, by giving them only a strong attraction or cohesion with the bodies to which they are joined?

135. The acid spirit or salt, that mighty instrument in the hand of nature, residing in the air, and diffused throughout that whole element, is discernible also in many parts of the earth, particularly in fossils, such as sulphur, vitriol, and alum. It was already observed, from Homberg, that this acid is never found pure, but hath always sulphur joined with it, and is classed by the difference of its sulphurs, whether mineral, vegetable, or animal.

136. Salts are vulgarly reckoned the most active of chemical principles. But Homberg derives all their activity from the sulphurs joined with them. From which also, as hath been said, he derives all their kinds and differences (sect. 129). Salt, water, oil, and earth seem to be originally the same in all vegetables. All the dif-

ference, according to the chemists, ariseth from a spirit residing in the oil, called the *rector* or *archæus*. This is otherwise called by chemists *ens primum*, or the native spirit; whereon depend, and wherein are contained, the peculiar flavour and odour, the specific qualities and virtues, of the plant[1].

137. These native spirits or vegetable souls are all breathed or exhaled into the Air[2], which seems the receptacle as well as source of all sublunary forms, the great mass or chaos which imparts and receives them. The air or atmosphere that surrounds our earth contains a mixture of all the active volatile parts of the whole habitable world, that is, of all vegetables, minerals, and animals. Whatever perspires, corrupts, or exhales, impregnates the air; which, being acted upon by the solar fire, produceth within itself all sorts of chemical operations, dispensing again those salts and spirits in new generations, which it had received from putrefactions.

138. The perpetual oscillations of this elastic and restless element operate without ceasing on all things that have life, whether animal or vegetable, keeping their fibres, vessels, and fluids in a motion, always changing; as heat, cold, moisture, dryness, and other causes alter the elasticity of the air: which accounts, it must be owned, for many effects. But there are many more which must be derived from other principles or qualities in the air. Thus iron and copper are corroded and gather rust in the air, and bodies of all sorts are dissolved or corrupted, which sheweth an acid to abound and diffuse itself throughout the air.

139. By this same air fire is kindled, the lamp of life preserved, respiration, digestion, nutrition, the pulse of the heart, and motion of all the muscles seem to be performed. Air therefore is a general agent, not only exerting its own, but calling forth the qualities or powers of all

[1] The chemists here spoken of as believing in an *archæus* were followers of Paracelsus. The *archæus* of Paracelsus seems to have been a supposed spiritual being.

[2] In sect. 135–152, he contemplates Air as the receptacle of the Acid or Vegetable Soul in which he supposes the virtue of tar-water to consist. The chemistry of the atmosphere was then unknown.

other bodies, by a division, comminution, and agitation of their particles, causing them to fly off and become volatile and active.

140. Nothing ferments, vegetates, or putrifies without air, which operates with all the virtues of the bodies included in it; that is, of all nature; there being no drug, salutary or poisonous, whose virtues are not breathed into the air. The air therefore is an active mass of numberless different principles, the general source of corruption and generation; on one hand dividing, abrading, and carrying off the particles of bodies, that is, corrupting or dissolving them; on the other, producing new ones into being; destroying and bestowing forms without intermission.

141. The seeds of things seem to lie latent in the air, ready to appear and produce their kind, whenever they light on a proper matrix. The extremely small seeds of fern, mosses, mushrooms, and some other plants are concealed and wafted about in the air, every part whereof seems replete with seeds of one kind or other. The whole atmosphere seems alive. There is everywhere acid to corrode, and seed to engender. Iron will rust, and mould will grow in all places. Virgin earth becomes fertile, crops of new plants ever and anon shew themselves; all which demonstrates the air to be a common seminary and receptacle of all vivifying principles.

142. Air may also be said to be the seminary of minerals and metals, as it is of vegetables. Mr. Boyle[1] informs us that the exhausted ores of tin and iron being exposed to the air become again impregnated with metal, and that ore of alum having lost its salt, recovers it after the same manner. And numberless instances there are of salts produced by the air; that vast collection or treasury of active principles, from which all sublunary bodies seem to derive their forms, and on which animals depend for their life and breath.

143. That there is some latent vivifying spirit dispersed

[1] In his *Observations about the growth of Metals in their ore, exposed to the Air.* See Boyle's *Works*, vol. III. pp. 459–462. Robert Boyle (1626–1692), an illustrious Irishman, often referred to by Berkeley, natural philosopher, chemist, and theologian, one of the founders of the Royal Society, and founder of the 'Boyle Lectures.' His *Life and Works*, edited by Dr. Birch, appeared in five vols. (1744).

throughout the air common experience sheweth; insomuch as it is necessary both to vegetables and animals (sect. 138, 139), whether terrestrial or aquatic, neither beasts, insects, birds, nor fishes being able to subsist without air. Nor doth all air suffice, there being some quality or ingredient of which when air is deprived it becometh unfit to maintain either life or flame. And this even though the air should retain its elasticity; which, by the bye, is an argument that air doth not act only as an antagonist to the intercostal muscles. It hath both that and many other uses. It gives and preserves a proper tone to the vessels: this elastic fluid promotes all secretions: its oscillations keep every part in motion: it pervades and actuates the whole animal system, producing great variety of effects, and even opposite in different parts, cooling at the same time and heating, distending and contracting, coagulating and resolving, giving and taking, sustaining life and impairing it, pressing without and expanding within, abrading some parts, at the same time insinuating and supplying others, producing various vibrations in the fibres and ferments in the fluids; all which must needs ensue from such a subtle, active, heterogeneous, and elastic fluid.

144. But there is, as we before observed, some one quality or ingredient in the air, on which life more immediately and principally depends. What that is, though men are not agreed, yet it is agreed it must be the same thing that supports the vital and the common flame; it being found that when air, by often breathing in it, is become unfit for the one, it will no longer serve for the other. The like is observable in poisonous damps or steams, wherein flame cannot be kindled, as is evident in the Grotto del Cane[1] near Naples. And here it occurs, to recommend the plunging them in cold water, as an experiment to be tried on persons affected by breathing a poisonous vapour in old vaults, mines, deep holes, or cavities under ground: which, I am apt to think, might save the lives of several, by what I have seen practised

[1] The *Grotto del Cane* is so charged with carbonic acid gas that light and life are speedily extinguished in it. It is described by Pliny, and seems to have been visited by Berkeley in his Italian tour.

on a dog convulsed, and in all appearance dead, but instantly reviving on being taken out of the above-mentioned Grotto, and thrown into a lake adjacent.

145. Air, the general menstruum and seminary, seemeth to be only an aggregate of the volatile parts of all natural beings, which, variously combined and agitated, produce many various effects. Small particles in a near and close situation strongly act upon each other, attracting, repelling, vibrating. Hence divers fermentations, and all the variety of meteors, tempests, and concussions both of earth and firmament. Nor is the microcosm less affected thereby. Being pent up in the viscera, vessels, and membranes of the body, by its salts, sulphurs, and elastic power, it engenders cholics, spasms, hysteric disorders, and other maladies.

146. The specific quality of air is taken to be permanent elasticity. Mr. Boyle is expressly of this opinion. And yet whether there be any such thing as permanently elastic air may be doubted, there being many things which seem to rob the air of this quality, or at least lessen and suspend its exertion. The salts and sulphurs, for instance, that float in the air abate much of its elasticity by their attraction.

147. Upon the whole, it is manifest that air is no distinct element, but a mass or mixture of things the most heterogeneous and even opposite to each other (sect. 137, 145), which become air by acquiring an elasticity and volatility from the attraction of some active subtle substance, whether it be called fire, æther, light, or the vital spirit of the world; in like manner as the particles of antimony, of themselves not volatile, are carried off in sublimation, and rendered volatile by cohering with the particles of sal ammoniac. But action and reaction being equal, the spring of this ethereal spirit is diminished by being imparted. Its velocity and subtlety are also less from its being mixed with grosser particles. Hence sound moves slower than light, as mud than water.

148. Whether air be only freed and fixed, or generated and destroyed, it is certain that air begins and ceases to exert or shew itself. Much by experiments seems to be generated, not only from animals, fruits, and vegetables, but also from hard bodies. And it is observed by Sir

Isaac Newton, that air produced from hard bodies is most elastic. The transmutation of elements, each into other, hath been anciently held. In Plutarch we find it was the opinion of Heraclitus, that the death of fire was a birth to air, and the death of air a birth to water[1]. This opinion is also maintained by Sir Isaac Newton. Though it may be questioned, whether what is thought a change be not only a disguise.

149. Fire seems the most elastic and expansive of all bodies. It communicates this quality to moist vapours and dry exhalations, when it heats and agitates their parts, cohering closely with them, overcoming their former mutual attraction, and causing them, instead thereof, reciprocally to repel each other, and fly asunder, with a force proportionable to that wherewith they had cohered.

150. Therefore in air we may conceive two parts; the one more gross, which was raised and carried off from the bodies of this terraqueous mass; the other a fine subtle spirit, by means whereof the former is rendered volatile and elastic. Together they compose a medium whose elasticity is less than that of pure æther, fire, or spirit, in proportion to the quantity of salts, vapours, and heterogeneous particles contained therein. Hence it follows that there is no such thing as the pure simple element of air. It follows also that on the highest mountains air should be more rare in proportion to the vulgar rule, of the spaces being reciprocally as the pressures: and so in fact it is said to have been found by the gentlemen of the French Academy of Sciences.

151. Æther, fire, or spirit, being attracted and clogged by heterogeneous particles, becometh less active; and the particles cohering with those of æther become more active

[1] See Ps.-Plutarch, *De Placit. Philos.* Lib. I. c. 3. Alchemy, or the ancient hypothesis that the apparent elements of matter may be transubstantiated into one ultimate element—implying that gold and silver may be produced from baser metals, and encouraging the search for a Panacea—was not neglected even in Berkeley's time. Newton had faith in alchemy, and devoted time to investigation of its processes. Leibniz, in his youth, was secretary to a society of Rosicrucians at Nuremberg, who practised alchemy. Alchemist speculation was not discouraged by Boyle and Locke. And the advanced science of our day has not abandoned the idea of scientific transubstantiation of matter.

than before. Air therefore is a mass of various particles, abraded and sublimated from wet and dry bodies of all sorts, cohering with particles of æther; the whole permeated by pure æther, or light, or fire: for these words are used promiscuously by ancient philosophers.

152. This Æther or pure invisible Fire[1], the most subtle and elastic of all bodies, seems to pervade and expand itself throughout the whole universe. If air be the immediate agent or instrument in natural things, it is the pure invisible fire that is the first natural mover or spring from whence the air derives its power (sect. 139, 149, 151). This mighty agent is everywhere at hand, ready to break forth into action, if not restrained and governed with the greatest wisdom. Being always restless and in motion, it actuates and enlivens the whole visible mass, is equally fitted to produce and to destroy, distinguishes the various stages of nature, and keeps up the perpetual round of generations and corruptions, pregnant with forms which it constantly sends forth and resorbs. So quick in its motions, so subtle and penetrating in its nature, so ex-

[1] We here (sect. 152–230) rise to a higher link in the Universal Chain, viz. Æther or invisible Fire. This, with Berkeley, connects all things in nature, and is thus their ultimate *physical* explanation. Fire has always been a mystery. It evades sense-perception; yet it seems to animate the phenomena of sense. Hence the supremacy attributed to it by the ancients. Whether fire is mechanically resolvable into motion, or motion is to be hyper-mechanically accounted for by animated fire, was a controverted alternative. Bacon, in the *Novum Organum*, concluded that heat and other sensible effects attributed to fire were due to motions in the particles of bodies —a doctrine favoured by Boyle and Newton. On the other hand, Berkeley's notion of animating, all-pervading fire, as the ultimate *physical* cause, to which all sensible changes are due, and under which the sensible universe is divinely concatenated, was countenanced among his contemporaries by Homberg and Boerhaave. Berkeley and this theory of fire are referred to in Richard Barton's *Analogy of Divine Wisdom* (Dublin, 2nd ed. 1750). 'Fire,' we are there told, 'is the universal fountain of life, order, distinction, stability, beauty of the universe. It is not only in the sun and other heavenly bodies, but it makes part of every lump of matter upon our globe. . . . So quick in its motion, so subtle and penetrating in its nature, so extensive in its effects; it seemeth no other than the Vegetative Soul and Vital Spirit of the World' (p. 63). See also [Casway's?] *Metaphysical Essay* (1748), pp. 32, &c.

tensive in its effects, it seemeth no other than the Vegetative Soul or Vital Spirit of the World.

153. [1] The animal spirit in man is the instrumental or physical cause both of sense and motion. To suppose sense in the world would be gross and unwarranted. But locomotive faculties[2] are evident in all its parts. The Pythagoreans, Platonists, and Stoics held the world to be an animal; though some of them have chosen to consider it as a vegetable[3]. However, the phænomena and effects do plainly shew there is a Spirit that moves, and a Mind or Providence that presides. This Providence, Plutarch[3] saith, was thought to be in regard to the world what the soul is in regard to man.

154. The order and course of things, and the experiments we daily make, shew there is a Mind that governs and actuates this mundane system, as the proper real agent and cause; and that the inferior instrumental cause is pure æther, fire, or the substance of light (sect. 29, 37, 136, 149), which is applied and determined by an Infinite Mind in the macrocosm or universe, with unlimited power, and according to stated rules, as it is in the microcosm with limited power and skill by the human mind. We have no proof, either from experiment or reason, of any other Agent, or efficient cause, than Mind or Spirit[4]. When, therefore, we speak of corporeal agents, or corporeal causes, this is to be understood in a different, subordinate, and improper sense[5].

[1] This and the three next sections, as well as sect. 160, 161, interpolate Berkeley's spiritual conception of Power, so prominent in the *De Motu*. They encourage the ancient doctrine of *anima mundi*, apparently to correct a tendency to suppose Fire *per se* the Universal Power.

[2] Cf. sect. 230.

[3] Cf. sect. 166, 172, 273–79, for the conception of the sensible universe as spiritually animated, not the mechanical result of inanimate force. The notion of eternal, all-pervading, vital Reason, not special creation, underlies ancient physical speculation. See Plato, *Timæus*, pp. 29, 30; Diog. Laert. Lib. VII.; Cicero, *De Nat. Deor.* Lib. II. c. 11; also Ps.-Plutarch, *De Placit. Philos.* Lib. V. c. 20.

[4] Cf. *Principles*, sect. 26–28.

[5] This implies that every change in nature presupposes a *sufficient* cause, and that this must be Active Reason; also that, in physical nature, *anything* might have been made by God the natural cause, i. e. natural sign, of *any* change.

155. The principles whereof a thing is compounded, the instrument used in its production, and the end for which it was intended, are all in vulgar use termed *causes*; though none of them be, strictly speaking, agent or efficient. There is not any proof that an extended corporeal or mechanical cause doth really and properly act; even motion itself being in truth a passion [1]. Therefore, though we speak of this fiery substance as *acting*, yet it is to be understood only as a mean or instrument; which indeed is the case of all mechanical causes whatsoever. They are, nevertheless, sometimes termed agents and causes, although they are by no means active in a strict and proper signification. When therefore force, power, virtue, or action is mentioned as subsisting in an extended and corporeal or mechanical being, this is not to be taken in a true, genuine, and real, but only in a gross and popular sense; which sticks in appearances, and doth not analyze things to their first principles. In compliance with established language and the use of the world, we must employ the popular current phrase. But then in regard to truth we ought to distinguish its meaning. It may suffice to have made this declaration once for all, in order to avoid mistakes.

156. The *calidum innatum*, the vital flame, or animal spirit in man, is supposed the *cause* of all motions in the several parts of his body, whether voluntary or natural. That is, it is accounted the instrument, by means whereof the *mind* exerts and manifests herself in the motions of the body. In the same sense, may not *fire* be said to have force, to operate and agitate the whole system of the world; which is held together, and informed by one presiding Mind; and animated throughout by one and the same fiery substance, as an instrumental and mechanical agent, not as a primary real efficient?

157. This pure spirit or invisible fire is ever ready to exert and shew itself in its effects (sect. 152), cherishing, heating, fermenting, dissolving, shining, and operating, in various manners, where a subject offers to employ or

[1] Cf. sect. 160; also *De Motu*, which teaches that all sensible things are passive, and that living and intending Spirit is the only sufficient cause.

determine its force. It is present in all parts of the earth and firmament, though perhaps latent and unobserved, till some accident produceth it into act, and renders it visible in its effects.

158. There is no effect in nature, great, marvellous, or terrible, but proceeds from Fire, that diffused and active principle, which, at the same time that it shakes the earth and heavens[1], will enter, divide, and dissolve the smallest, closest, and most compacted bodies. In remote cavities of the earth it remains quiet, till perhaps an accidental spark, from the collision of one stone against another, kindles an exhalation that gives birth to an earthquake or tempest which splits mountains or overturns cities. This same fire stands unseen in the focus of a burning glass, till subjects for it to act upon come in its way, when it is found to melt, calcine, or vitrify the hardest bodies.

159. No eye could ever hitherto discern, and no sense perceive, the animal spirit in a human body, otherwise than from its effects. The same may be said of pure fire, or the spirit of the universe, which is perceived only by means of some other bodies, on which it operates, or with which it is joined. What the chemists say of pure acids being never found alone might as well be said of pure fire.

160. The mind of man acts by an instrument *necessarily*[2]. The τὸ ἡγεμονικόν, or Mind presiding in the world, acts by an instrument *freely*. Without instrumental and second causes, there could be no regular course of nature. And without a regular course, nature could never be understood; mankind must always be at a loss, not knowing what to expect, or how to govern themselves, or direct their actions for the obtaining of any end. Therefore in the government of the world physical agents, improperly so called, or mechanical, or second causes, or natural causes, or

[1] Cf. Hebrews xii. 26–29.

[2] This is in the spirit of the opening aphorisms of the *Novum Organum*, which teach that in order to bring about changes in nature *man* must conform to the established laws which determine the changes. A divinely maintained sense-symbolism is with Berkeley the basis of human science of nature. Nature is thus fundamentally supernatural. Physical inquiry may disregard its supernatural side: philosophy (unless it is 'minute') recognises both sides.

instruments, are necessary to assist, not the governor, but the governed[1].

161. In the human body the mind orders and moves the limbs: but the animal spirit is supposed the immediate physical cause of their motion. So likewise in the mundane system, a mind presides: but the immediate, mechanical, or instrumental cause, that moves or animates all its parts, is the pure elementary fire or spirit of the world. The more fine and subtle part or spirit is supposed to receive the impressions of the First Mover, and communicate them to the grosser sensible parts of this world. Motion, though in metaphysical rigour and truth a passion or mere effect, yet in physics passeth for an action[2]. And by this action all effects are supposed to be produced. Hence the various communications, determinations, accelerations of motion, constitute the laws of nature.

162. The pure æther or invisible fire contains parts of different kinds, that are impressed with different forces, or subjected to different laws of motion, attraction, repulsion, and expansion, and endued with divers distinct habitudes towards other bodies. These seem to constitute the many various qualities (sect. 37, 40, 44), virtues, flavours, odours, and colours which distinguish natural productions. The different modes of cohesion, attraction, repulsion, and motion appear to be the source from whence specific properties are derived, rather than different shapes or figures. This, as hath been already observed[3], seems confirmed by the experiment of fixed salts operating one way, notwithstanding the difference of their angles. The original particles, productive of odours, flavours, and other

[1] Cf. with this important parenthetical section, Berkeley's *Principles*, sect. 60-66, in which he explains and vindicates the function of natural causes and the office of physical science, under his new conception of matter. He thus explains how, if God is the only agent in natural law, there is still room for the elaborate sense-symbolism or material world, which man is busy in interpreting and using.

[2] Cf. sect. 155, and the *De Motu*, passim. With Berkeley *motion* is a sensible manifestation of the animated and invisible Fire. His ultimate conception is that of a living and teleological, not a blindly moved, universe—movement being the expression of all-pervading life and meaning. It is taken for granted that Life is inexplicable by mechanical or chemical laws, and is presupposed in all real existence.

[3] Cf. sect. 131-133.

properties, as well as of colours, are, one may suspect, all contained and blended together in that universal and original seminary of pure and elementary fire; from which they are diversely separated and attracted, by the various subjects of the animal, vegetable, and mineral kingdoms; which thereby become classed into kinds, and endued with those distinct properties which continue till their several forms, or specific proportions of fire, return into the common mass.

163. As the soul acts immediately on pure fire, so pure fire operates immediately on air; that is, the abrasions of all terrestrial things being rendered volatile and elastic by fire (sect. 149, 150, 152), and at the same time lessening the volatility and expansive force of the fire, whose particles they attract and adhere to (sect. 147), there is produced a new fluid, more volatile than water or earth, and more fixed than fire. Therefore, the virtues and operations imputed to air must be ultimately attributed to fire, as that which imparts activity to air itself.

164. The element of æthereal fire or light seems to comprehend, in a mixed state, the seeds, the natural causes and forms (sect. 43), of all sublunary things. The grosser bodies separate, attract, and repel the several constituent particles of that heterogeneous element; which, being parted from the common mass, make distinct essences, producing and combining together such qualities and properties as are peculiar to the several subjects, and thence often extracted in essential oils or odoriferous waters, from whence they exhale into the open air, and return into their original element.

165. Blue, red, yellow, and other colours, have been discovered by Sir Isaac Newton to depend on the parted rays or particles of light. And, in like manner, a particular odour or flavour seemeth to depend on peculiar particles of light or fire (sect. 40); as appears from heats being necessary to all vegetation whatsoever, and from the extreme minuteness and volatility of those vegetable souls or forms, flying off from the subjects without any sensible diminution of their weight. These particles, blended in one common ocean, should seem to conceal the distinct forms, but, parted and attracted by proper subjects, disclose or produce them. As the particles of

light, which, when separated, form distinct colours, being blended are lost in one uniform appearance.

166. Agreeably thereto [1] an æthereal substance or Fire was supposed by Heraclitus [2] to be the seed of the generation of all things, or that from which all things drew their original. The Stoics also taught that all substance was originally fire, and should return to fire: that an active subtle fire was diffused or expanded throughout the whole universe; the several parts whereof were produced, sustained, and held together, by its force [3]. And it was the opinion of the Pythagoreans, as Laertius informs us, that heat or fire was the principle of life, animating the whole system, and penetrating all the elements (sect. 152, 153). The Platonists, too, as well as the Pythagoreans, held fire to be the immediate natural agent, or animal spirit; to cherish, to warm, to heat, to enlighten, to vegetate, to produce the digestions, circulations, secretions, and organical motions, in all living bodies, vegetable or animal, being effects of that element, which, as it actuates the macrocosm, so it animates the microcosm. In the *Timæus* [4] of Plato, there is supposed something like a net of fire and rays of fire in a human body. Doth not this seem to mean the animal spirit, flowing, or rather darting, through the nerves?

167. According to the Peripatetics, the form of heaven, or the fiery æthereal substance, contains the form of all inferior beings (sect. 43). It may be said to teem with forms, and impart them to subjects fitted to receive them.

[1] In sect. 166–187 we have a collection of authorities—Greek (sect. 166–176) and Oriental (sect. 177–187)—in support of the hypothesis that *æther* or *fire* is the ultimate, informing and unifying, *natural* cause of change in bodies.

[2] Schleiermacher, Bernays, Lassalle, Zeller, and others have cast fresh light on Heraclitus; the most grandly suggestive figure of the Pre-Socratic age, from whom the 'philosophy of fire' descends. The Germans have disinterred 'the dark philosopher,' long *nominis umbra*, in recent histories and monographs. See especially the *Philosophie Herakleitos des Dunkeln* (1858) of Lassalle. In Ferrier's *Lectures on Greek Philosophy* (1866) there is an interesting account of Heraclitus.

[3] Berkeley seems to found on Diogenes Laertius and the Pseudo-Plutarch. See Zeller's *Philosophie der Griechen*, for the elemental fire, or world-soul, of the Stoics.

[4] Pp. 45, 78.

The vital force thereof in the Peripatetic sense is vital to all, but diversely received according to the diversity of the subjects. So all colours are virtually contained in the light; but their actual distinctions of blue, red, yellow, and the rest, depend on the difference of the objects which it illustrates. Aristotle, in the book *De Mundo*[1], supposeth a certain fifth essence, an æthereal nature, unchangeable and impassive; and next in order a subtle flaming substance, lighted up or set on fire by that æthereal and Divine nature. He supposeth, indeed, that God is in heaven, but that His power, or a force derived from Him, doth actuate and pervade the universe.

168. If we may credit Plutarch[2], Empedocles thought æther or heat to be Jupiter. Æther by the ancient philosophers was used to signify promiscuously sometimes fire and sometimes air. For they distinguish two sorts of air. Plato, in the *Timæus*[3], speaking of air, saith there are two kinds; the one more fine and subtle, called æther; the other more gross, and replete with vapours. This æther or purer medium seems to have been the air or principle from which all things, according to Anaximenes, derived their birth, and into which they were back again resolved at their death. Hippocrates, in his treatise *De Diæta*[4], speaketh of a fire pure and invisible; and this fire, according to him, is that which, stirring and giving movement to all things, causes them to appear, or, as he styles it, come into evidence, that is, to exist, every one in its time, and according to its destiny.

169. This pure fire, æther, or substance of light was accounted in itself invisible and imperceptible to all our senses, being perceived only by its effects, such as heat, flame, and rarefaction.—To which we may add, that the Moderns pretend farther to have perceived it by weight, inasmuch as the aromatic oils which most abound with fire, as being the most readily and vehemently inflamed,

[1] See cap. 2. The *De Mundo* is not now accepted as Aristotle's.

[2] Ps.-Plutarch, *De Placit. Philos.* Lib. I. c. 3.

[3] P. 58.

[4] *Opera*, tom. I. p. 639 (ed. Leips. 1825). An unsuspected relation between Hippocrates (B. C. 460–357) and Heraclitus (cir. B. C. 500–460) was discovered by the research of Professor Bernays of Bonn, in his *Heraclitea*, where he traces, with acuteness, a series of quotations from Heraclitus embedded in the text of the *De Diæta*.

are above all others the heaviest. And by an experiment of Mr. Homberg's, four ounces of regulus of antimony, being calcined by a burning-glass for an hour together, were found to have imbibed and fixed seven drachms of the substance of light.

170. Such is the rarefying and expansive force of this element, as to produce, in an instant of time, the greatest and most stupendous effects: a sufficient proof not only of the power of fire, but also of the wisdom with which it is managed, and withheld from bursting forth every moment to the utter ravage and destruction of all things. And it is very remarkable that this same element, so fierce and destructive, should yet be so variously tempered and applied as to be withal the salutary warmth, the genial, cherishing, and vital flame of all living creatures. It is not therefore to be wondered that Aristotle[1] thought the heat of a living body to be somewhat Divine and celestial, derived from that pure æther to which he supposed the incorporeal Deity (χωριστὸν εἶδος) to be immediately united, or on which he supposed it immediately to act.

171. The Platonists held that intellect resided in soul, and soul in an æthereal vehicle. And that as the soul was a middle nature, reconciling intellect with æther, so æther was another middle nature, which reconciled and connected the soul with grosser bodies (sect. 152, 154). Galen[2] likewise taught that, admitting the soul to be incorporeal, it hath for its immediate tegument or vehicle

[1] See *De Anim. Generat.* Lib. III. c. 11; also *De Anima*, Lib. II. c. 4. Aristotle is apt to refer the connexion of soul and body to universally diffused animal heat; a notion which the Stoics carried further, in identifying God, or the world-soul, with the vital Fire. On the physics and cosmology of the Stoics, see Plutarch, *De Stoic. Rep.* 41; Stob. *Ecl. Phys.* I, and Diog. Laert. Lib. VII; also Zeller. Like Heraclitus, they regarded fire as the universal cosmological force, which regulates the mundane system, and under which, after regular evolution in the ages, it is to dissolve in a universal conflagration.

[2] See *Opera*, tom. IV. p. 470 (ed. Bas.) for a passage which partly corresponds to this. Galen (A.D. 130–201) would be the most learned physician, and one of the most voluminous writers of antiquity, if all the works attributed to him could be received as genuine. In the treatise on Hippocrates and Plato, and in other Galenic works, may be found passages on Fire not unlike that referred to, but I have not found any exactly corresponding to it. Galen was an admirer of Hippocrates; for whose doctrine on this subject, cf. sect. 168, 174, 175.

a body of æther or fire, by the intervention whereof it moveth other bodies, and is mutually affected by them. This interior clothing was supposed to remain upon the soul, not only after death, but after the most perfect purgation, which, in length of time, according to the followers of Plato and Pythagoras, cleansed the soul,

'purumque reliquit
Æthereum sensum, atque auraï simplicis ignem[1].'

This tunicle of the soul, whether it be called pure æther, or luciform vehicle, or animal spirit, seemeth to be that which moves and acts upon the gross organs, as it is determined by the soul from which it immediately receives impression, and in which the moving force truly and properly resides. Some moderns have thought fit to deride all that is said of æthereal vehicles, as mere jargon or words without a meaning. But they should have considered that all speech concerning the soul is altogether, or for the most part, metaphorical; and that, agreeably thereunto, Plato[2] speaketh of the mind or soul, as a driver that guides and governs a chariot, which is, not unfitly, styled αὐγήειδες, a luciform æthereal vehicle or ὄχημα—terms expressive of the purity, lightness, subtlety, and mobility of that fine celestial nature in which the soul immediately resides and operates.

172. It was a tenet of the Stoics that the world was an animal, and that Providence answered to the reasonable soul in man. But then the Providence or Mind was supposed by them to be immediately resident or present in fire, to dwell therein, and to act thereby. Briefly, they conceived God to be an intellectual and fiery spirit, πνεῦμα νοερὸν καὶ πυρῶδες. Therefore, though they looked on fire (sect. 166) as the τὸ ἡγεμονικόν or governing principle of the world; yet it was not simply fire, but animated with a mind.

173. Such are the bright and lively signatures of a Divine Mind, operating and displaying itself in fire and light throughout the world, that, as Aristotle observes, in his book *De Mundo*[3], all things seem full of divinities, whose apparitions on all sides strike and dazzle our eyes.

[1] Virgil, *Æneid* VI. 746.
[2] *Phædrus*, p. 246. Cf. *Alciphron*, Dial. VII. 16.
[3] Cap. 6. Cf. p. 305, note 1. But the *De Mundo* is not by Aristotle.

And it must be owned the chief philosophers and wise men of antiquity, how much soever they attributed to second causes and the force of fire, yet they supposed a Mind or Intellect always resident therein, active or provident, restraining its force, and directing its operations.

174. Thus Hippocrates, in his treatise *De Diæta*[1], speaks of a strong but invisible fire (sect. 168), that rules all things without noise. Herein, saith he, reside soul, understanding, prudence, growth, motion, diminution, change, sleep, and waking. This is what governs all things, and is never in repose. And the same author, in his tract *De Carnibus*[2], after a serious preface, setting forth that he is about to declare his own opinion, expresseth it in these terms:—'That which we call heat, θερμόν, appears to me something immortal, which understands all things, which sees and knows both what is present and what is to come.'

175. This same heat is also what Hippocrates calls nature, the author of life and death, good and evil. It is farther to be noted of this heat, that he maketh it the object of no sense. It is that occult universal nature, and inward invisible force, which actuates and animates the whole world, and was worshipped by the ancients under the name of Saturn; which Vossius judges not improbably to be derived from the Hebrew word *satar*, to lie hidden or concealed. And what hath been delivered by Hippocrates agrees with the notions of other philosophers: Heraclitus (sect. 157), for instance, who held fire to be the principle and cause of the generation of all things, did not mean thereby an inanimate element, but, as he termed it, πῦρ ἀείζωον, an everlasting fire[3].

176. Theophrastus, in his book *De Igne*, distinguisheth between heat and fire. The first he considers as a principle or cause; not that which appeareth to sense as a passion or accident existing in a subject, and which is in truth the effect of that unseen principle. And it is remarkable that he refers the treating of this invisible fire

[1] *Opera*, tom. I. p. 639.

[2] The original is as follows:—Δοκέει δέ μοι τὸ καλεόμενον θερμόν, ἀθάνατόν τε εἶναι, καὶ νοεῖν πάντα, καὶ ὁρῆν καὶ ἀκούειν καὶ εἰδέναι πάντα, καὶ τὰ ὄντα καὶ τὰ μέλλοντα ἔσεσθαι. *Opera*, tom. I. p. 425.

[3] See Ritter and Preller, No. 34; Heracl. ap. Clem. Alex. *Strom.* V. p. 599. Matter was in a manner spiritualised in the Fire of Heraclitus, called ψυχή by Aristotle (*De Anima*, Lib. I. c. 2).

or heat to the investigation of the First Causes. Fire, the principle, is neither generated nor destroyed, is everywhere and always present (sect. 157); while its effects in different times and places shew themselves more or less, and are very various, soft and cherishing, or violent and destructive, terrible or agreeable, conveying good and evil, growth and decay, life and death, throughout the mundane system[1].

177. It is allowed by all that the Greeks derived much of their philosophy from the Eastern nations[2]. And Heraclitus is thought by some to have drawn his principles from Orpheus, as Orpheus did from the Egyptians; or, as others write, he had been auditor of Hippasus, a Pythagorean, who held the same notion of fire, and might have derived it from Egypt by his master Pythagoras, who had travelled into Egypt, and been instructed by the sages of that nation. One of whose tenets it was, that fire was the principle of all action; which is agreeable to the doctrine of the Stoics, that the whole of things is administered by a fiery intellectual spirit. In the *Asclepian Dialogue*[3], we find this notion, that all parts of the world vegetate by a fine subtle aether, which acts as an engine or instrument, subject to the will of the supreme God.

178. As the Platonists held intellect to be lodged in soul, and soul in æther (sect. 171); so it passeth for a doctrine of Trismegistus in the Pimander[4], that mind is clothed by soul, and soul by spirit. Therefore, as the animal spirit of man, being subtle and luminous, is the immediate tegument of the human soul, or that wherein and whereby she acts; even so the spirit of the world, that active fiery ethereal substance of Light, that permeates and animates the whole system, is supposed to clothe the soul, which clothes the mind of the universe.

179. The Magi likewise said of God, that He had light for His body and truth for His soul. And in the Chaldaic

[1] Theophrastus dwells on the distinction between θερμός and πῦρ in various parts of this treatise.

[2] In sect. 177–187 Berkeley turns to the East.

[3] One of the famous Hermic Books, but not by Hermes; Egyptian in doctrine, while written in Greek, and entitled, Ὁ τέλειος λόγος.

[4] *Pœmander*, the most celebrated of the Hermic writings—not by Hermes.

oracles, all things are supposed to be governed by a πῦρ νοερόν, or intellectual fire. And in the same oracles, the creative mind is said to be clothed with fire, ἐσσάμενος πυρὶ πῦρ, which oriental reduplication of the word fire seems to imply the extreme purity and force thereof. Thus also in the Psalms, 'Thou art clothed with light as with a garment.' Where the word rendered light might have been rendered fire; the Hebrew letters being the same with those in the word which signifies fire, all the difference being in the pointing, which is justly counted a late invention. That other Scripture sentence is remarkable: 'Who maketh his ministers a flaming fire[2]:' which might, perhaps, be rendered more agreeably to the context, as well as consistently with the Hebrew, after this manner: 'Who maketh flaming fire his ministers:' and the whole might run thus: 'Who maketh the winds his messengers, and flaming fire his ministers.'

180. A notion of something Divine in fire, animating the whole world, and ordering its several parts, was a tenet of very general extent (sect. 156, 157, 163, 166, 167, 168, 170, 172, 173, 174, 175, 177, &c.), being embraced in the most distant times and places, even among the Chinese themselves; who make *tien*, æther, or heaven, the sovereign principle or cause of all things, and teach that the celestial virtue, by them called *li*, when joined to a corporeal substance, doth fashion, distinguish, and specificate all natural beings. This *li* of the Chinese seems to answer the forms of the Peripatetics, and both bear analogy to the foregoing philosophy of fire[1].

181. The heaven is supposed pregnant with virtues and forms, which constitute and discriminate the various species of things. And we have more than once observed that, as the light, fire, or celestial æther, being parted by refracting or reflecting bodies, produceth variety of colours; even so, that same apparently uniform substance, being parted and secreted by the attracting and repelling powers of the divers secretory ducts of plants and animals, that is, by natural chemistry, produceth or imparteth the various specific properties of natural bodies. Whence the tastes, and odours, and medicinal virtues so various in vegetables.

[1] So, too, the Celtic festival of *Beltien*, originally connected with fire-worship.

182. The *tien* is considered and adored by the learned Chinese as living and intelligent æther, the πῦρ νοερόν of the Chaldeans and the Stoics. And the worship of things celestial, the sun and stars, among the Eastern nations less remote, was on account of their fiery nature, their heat and light, and the influence thereof. Upon these accounts, the sun was looked on by the Greek theologers as the spirit of the world, and the power of the world[1]. The cleansing quality, the light and heat of fire, are natural symbols of purity, knowledge, and power, or, if I may so say, the things themselves, so far as they are perceptible to our senses, or in the same sense as motion is said to be action. Accordingly, we find a religious regard was paid to fire, both by Greeks and Romans, and indeed by most, if not all, the nations of the world.

183. The worship of Vesta at Rome was, in truth, the worship of fire.

'Nec tu aliud Vestam quam vivam intellige flammam,'

saith Ovid in his Fasti[2]. And as in old Rome the eternal fire was religiously kept by virgins, so in Greece, particularly at Delphi and Athens, it was kept by widows. It is well known that Vulcan or fire was worshipped with great distinction by the Egyptians. The Zabii or Sabeans are also known to have been worshippers of fire. It appears too, from the Chaldean oracles, that fire was regarded as Divine by the sages of that nation. And it is supposed that Ur of the Chaldeans was so called from the Hebrew word signifying fire, because fire was publicly worshipped in that city. That a religious worship was paid to fire by the ancient Persians and their Magi is attested by all antiquity. And the sect of Persees, or old Gentiles, of whom there are considerable remains at this day both in the Mogul's country and in Persia, doth testify the same.

184. It doth not seem that their prostrations before the perpetual fires, preserved with great care in their Pyreia, or fire temples, were merely a civil respect, as Dr. Hyde would have it thought. Although he brings good proof that they do not invoke the fire on their altars, or pray

[1] See Professor Max Müller, on the original elements of mythology, in the *Oxford Essays* (1856), and in his Gifford Lectures. The development of Sun-worship is a curious subject in comparative religion.

[2] Lib. VI. 291.

to it, or call it God: and that they acknowledge a supreme invisible Deity. Civil respects are paid to things as related to civil power: but such relation doth not appear in the present case. It should seem, therefore, that they worship God as present in the fire, which they worship or reverence not ultimately or for itself, but relatively to the supreme Being. Which it is not unlikely was elsewhere the case at first, though the practice of men, especially of the vulgar, might in length of time degenerate from the original institution, and rest in the object of sense.

185. Doctor Hyde, in his *History of the Religion of the Ancient Persians*, would have it thought that they borrowed the use and reverence of perpetual fires, from the Jewish practice prescribed in the Levitical law of keeping a perpetual fire burning on the altar[1]. Whether that was the case or not, thus much one may venture to say: it seems probable that, whatever was the original of this custom among the Persians, the like customs among the Greeks and Romans were derived from the same source.

186. It must be owned there are many passages in Holy Scripture (sect. 179) that would make one think the Supreme Being was in a peculiar manner present and manifest in the element of Fire. Not to insist that God is more than once said to be a consuming fire, which might be understood in a metaphorical sense, the Divine apparitions were by fire, in the bush, at Mount Sinai, on the tabernacle, in the cloven tongues. God is represented in the inspired writings, as descending in fire, as attended by fire, or with fire going before Him. Celestial things, as angels, chariots, and such-like phænomena, are invested with fire, light, and splendour. Ezekiel in his visions beheld fire and brightness, lamps, burning coals of fire, and flashes of lightning. In a vision of Daniel, the throne of God appeared like a fiery flame, and His wheels like burning fire. Also a fiery flame issued and came forth from before Him.

187. At the transfiguration, the apostles saw our Saviour's face shining as the sun, and His raiment white as light, also a lucid cloud, or body of light, out of which the voice

[1] See his *Veterum Persarum et Medorum Religionis Historia*, c. 6, 8. Dr. Hyde (1636-1703) was Professor of Hebrew in Oxford, and Canon of Christ Church.

came; which visible light and splendour were, not many centuries ago, maintained by the Greek church to have been Divine, and uncreated, and the very glory of God; as may be seen in the History wrote by the Emperor John Cantacuzene[1]. And of late years Bishop Patrick gives it as his opinion, that in the beginning of the world the Shechinah, or Divine presence, which was then frequent and ordinary, appeared by light or fire. In commenting on that passage, where Cain is said to have gone out from the presence of the Lord, the Bishop observes, that if Cain after this turned a downright idolater, as many think, it is very likely he introduced the worship of the sun, as the best resemblance he could find of the glory of the Lord, which was wont to appear in a flaming light. It would be endless to enumerate all the passages of Holy Scripture, which confirm and illustrate this notion, or represent the Deity as appearing and operating by fire; the misconstruction of which might possibly have misled the Gnostics, Basilidians, and other ancient heretics into an opinion that Jesus Christ was the visible corporeal sun.

188. We have seen that in the most remote ages and countries, the vulgar as well as the learned, the institutions of lawgivers as well as the reasonings of philosophers have ever considered the element of fire in a peculiar light, and treated it with more than common regard, as if it were something of a very singular and extraordinary nature. Nor are there wanting authors of principal account among the Moderns who entertain like notions concerning fire, especially among those who are most conversant in that element, and should seem best acquainted with it[2].

189. Mr. Homberg, the famous modern chemist, who brought that art to so great perfection, holds the substance of light or fire to be the true chemic principle sulphur (sect. 129), and to extend itself throughout the whole universe. It is his opinion that this is the only

[1] Cantacuzeni *Historiarum* Lib. II. c. 39, 40. John V, Byzantine emperor (Joannes Cantacuzenus), born about 1292. In 1354 he abdicated, and betook himself to a monastic life, when he wrote a History of the Eastern Empire during the former part of the fourteenth century. He ranks as one of the Byzantine historians.

[2] Sect. 188-205 refer chiefly to modern authorities in support of the 'Fire philosophy.'

active principle; that mixed with various things it formeth several sorts of natural productions: with salts making oil, with earth bitumen, with mercury metal; that this principle of sulphur, fire, or the substance of light, is in itself imperceptible, and only becomes sensible as it is joined with some other principle, which serves as a vehicle for it; that, although it be the most active of all things, yet it is at the same time the most firm bond and cement to combine and hold the principles together, and give form to the mixed bodies; and that in the analysis of bodies it is always lost, escaping the skill of the artist, and passing through the closest vessels [1].

190. Boerhaave[2], Nieuwentyt[3], and divers other moderns[4] are in the same way of thinking. They with the ancients distinguish a pure elementary invisible fire from the culinary, or that which appears in ignited bodies (sect. 163, 166). This last they will not allow to be pure fire. The pure fire is to be discerned by its affects alone; such as heat, dilatation of all solid bodies, and rarefaction of fluids, the segregating heterogeneous bodies, and congregating those that are homogeneous. That therefore which smokes and flames is not pure fire, but that which is collected in the focus of a [5 concave] mirror or burning-glass. This fire seems the source of all the operations

[1] See Homberg's *Essais du Soufre-Principe*, in the Memoirs of the Academy (1705), where he maintains that sulphur, when assumed to be the primary ingredient in all bodies, is fire; and thus that fire is coeval and coextensive with body. When chemists of the school to which Berkeley here refers speak of Fire as the elementary substance, they generally mean (as far as meaning can be found in their words) elementary sulphur.

[2] In his *Elementa Chemiæ* Boerhaave represents fire as the *natural* cause of motion—its true activity being referred to spiritual or intending agency.

[3] Bernard Nieuwentyt (1654-1718), a Dutch physician, mathematician, and natural theologian. His criticism of the differential calculus called forth John Bernoulli and Leibniz in defence.

In natural theology he curiously anticipates Paley's well-known illustration of the watch. See the English translation of Nieuwentyt's *Religious Philosopher* (1730), Preface, pp. 46-49.

[4] Thus, S. Gravesande argues that fire is the catholic element in Nature, obtainable from all bodies by friction, which puts their latent fire in motion (*Element. Phys.* l. 2. c. 1); and Lemery, the younger, asserts the ingenerable nature of fire, arguing that it is equally diffused through space, and the universal element in bodies (*Mém. de l'Acad.*, 1713).

[5] Not in the early editions.

in nature: without it nothing either vegetates or putrefies, lives or moves or ferments, is dissolved or compounded or altered, throughout this whole natural world in which we subsist. Were it not for this, the whole would be one great stupid inanimate mass. But this active element is supposed to be everywhere, and always present, imparting different degrees of life, heat, and motion to the various animals, vegetables, and other natural productions, as well as to the elements themselves wherein they are produced and nourished.

191. As water acts upon salt, or aquafortis upon iron, so fire dissolves all other bodies. Fire, air, and water are all three menstruums: but the two last seem to derive all their force and activity from the first (sect. 149). And indeed there seems to be, originally or ultimately, but one menstruum in nature, to which all other menstruums may be reduced. Acid salts are a menstruum, but their force and distinct powers are from sulphur. Considered as pure, or in themselves, they are all of the same nature. But, as obtained by distillation, they are constantly joined with some sulphur, which characterizeth and cannot be separated from them. This is the doctrine of Monsieur Homberg. But what is it that characterizeth or differenceth the sulphurs themselves? If sulphur be the substance of light, as that author will have it, whence is it that animal, vegetable, and metallic sulphurs impart different qualities to the same acid salt? Can this be explained upon Homberg's principles? And are we not obliged to suppose that light, separated by the attracting and repelling powers in the strainers, ducts, and pores of those bodies, doth form several distinct kinds of sulphur, all which, before such separation, were lost and blended together, in one common mass of light or fire, seemingly homogeneous?

192. In the analysis of inflammable bodies, the fire or sulphur is lost, and the diminution of weight sheweth the loss (sect. 169). Oil is resolved into water, earth, and salt, none of which is inflammable. But the fire or *vinculum* which connected those things, and gave the form of oil, escapes from the artist. It disappears but is not destroyed. Light or fire imprisoned made part of the compound, gave union to the other parts, and form

to the whole. But, having escaped, it mingles with the general ocean of æther, till, having again parted and attracted, it enters and specificates some new subject of the animal, vegetable, or mineral kingdom. Fire, therefore, in the sense of philosophers, is always fire, though not always flame.

193. Solar fire or light, in calcining certain bodies, is observed to add to their weight[1]. There is therefore no doubt but light can be fixed, and enter the composition of a body. And though it should lie latent for a long time, yet, being set free from its prison, it shall still shew itself to be fire. Lead, tin, or regulus of antimony, being exposed to the fire of a burning-glass, though they lose much in smoke and steam, are nevertheless found to be considerably increased in weight, which proves the introduction of light or fire into their pores. It is also observed that urine produceth no phosphorus unless it be long exposed to the solar light. From all which it may be concluded, that bodies attract and fix the light; whence it should seem, as some have observed, that fire without burning is an ingredient in many things, as water without wetting.

194. Of this there cannot be a better proof than the experiment of Monsieur Homberg, who made gold of mercury by introducing light into its pores, but at such trouble and expense, that I suppose nobody will try the experiment for profit. By this junction of light and mercury, both bodies became fixed, and produced a third different from either, to wit, real gold. For the truth of which fact, I refer to the Memoirs of the French Academy of Sciences[2]. From the foregoing experiment it appears that gold is only a mass of mercury penetrated and cemented by the substance of light, the particles of those bodies attracting and fixing each other. This seems to have been not altogether unknown to former philosophers; Marcilius Ficinus[3], the Platonist, in his com-

[1] Cf. sect. 169. This was Boyle's explanation, long ago exploded, like many of the other chemical explanations accepted in these sections.

[2] See Homberg's *Mémoire* (1700) —'Sur les Dissolvans du Mercure.' In Barton's *Analogy* this passage in *Siris* is referred to.

[3] Marcilius Ficinus (1433–99), the famous Florentine physician and philosopher, who led the revival of Platonism and Neoplatonism. He translated or commented

mentary on the first book of the second Ennead of Plotinus, and others likewise before him, regarding mercury as the mother, and sulphur as the father of metals; and Plato himself, in his Timæus describing gold to be a dense fluid with a shining yellow light, which well suits a composition of light and mercury[1].

195. Fire or light mixeth with all bodies (sect. 157), even with water; witness the flashing lights in the sea, whose waves seem frequently all on fire. Its operations are various according to its kind, quantity, and degree of vehemence. One degree keeps water fluid, and another turns it into elastic air (sect. 149). And air itself seems to be nothing else but vapours and exhalations, rendered elastic by fire. Nothing flames but oil; and sulphur with water, salt, and earth compose oil, which sulphur is fire: therefore fire enclosed attracts fire, and causeth the bodies whose composition it enters to burn and blaze.

196. Fire collected in the focus of a glass operates in vacuo, and therefore is thought not to need air to support it. Calx of lead hath gone off with an explosion in vacuo, which Nieuwentyt and others take for a proof that fire can burn without air. But Mr. Hales[2] attributes this effect to air enclosed in the red lead, and perhaps too in the receiver, which cannot be perfectly exhausted.

on Plato, Plotinus, Jamblicus, and Proclus. Ficinus, with his affinity for Neoplatonism, and for Hermic and Oriental lore, his endeavours to harmonise Plato and Aristotle, and his aspirations to reunion with God through a contemplative life, seems to have attracted Berkeley strongly in his later days. Berkeley appears to have studied Plotinus and the other Neoplatonists largely through Ficinus, who may have led him to recognise the community of some of their doctrines with his own early philosophy. It was perhaps from the eclecticism of Ficinus that he was induced to mix up the opinions of earlier and later philosophers with those of Plato.

[1] This curious section, with its authorities in support of alchemy—the speculation attributed originally to Hermes Trismegistus, and which seemed to culminate in Paracelsus and Marcilius Ficinus, Lully and Van Helmont—has some affinity with facts and speculations in recent chemistry in its tendency to ultimate unity of elements. Cf. sect. 69, 71, on mercury as a supposed Catholicon; and sect. 148, on the transmutation of the supposed elements. For Plato on gold, see *Timæus*, p. 59.

[2] *Statical Essays*, vol. I. pp. 278–80. This is Dr. Stephen Hales (1677–1761), rector of Teddington, who afterwards wrote on Tar-water, and to whom Berkeley addressed a *Letter* on its virtues in the Plague.

When common lead is put into the fire in order to make red lead, a greater weight of this comes out than was put in of common lead. Therefore the red lead should seem impregnated with fire. Mr. Hales thinks it is with air. The vast expansion of compound aqua fortis, Mr. Nieuwentyt will have to proceed from fire alone. Mr. Hales contends that air must necessarily co-operate. Though, by Nieuwentyt's experiment, it should seem the phosphorus burns equally with and without air.

197. Perhaps they who hold the opposite sides in this question may be reconciled by observing that air is in reality nothing more than particles of wet and dry bodies volatilized and rendered elastic by fire (sect. 147, 150, 151). Whatever, therefore, is done by air must be ascribed to fire; which fire is a subtle invisible thing, whose operation is not to be discerned but by means of some grosser body, which serves not for a pabulum to nourish the fire, but for a vehicle to arrest and bring it into view. Which seems the sole use of oil, air, or any other thing that vulgarly passeth for a pabulum or food of that element.

198. To explain this matter more clearly, it is to be observed that fire, in order to become sensible, must have some object to act upon. This, being penetrated and agitated by fire, affects us with light, heat, or some other sensible alteration. And this subject so wrought upon may be called culinary fire. In the focus of a burning-glass exposed to the sun, there is real actual fire; though not discerned by the sense till it hath somewhat to work on, and can shew itself in its effects, heating, flaming, melting, and the like. Every ignited body is, in the foregoing sense, culinary fire. But it will not therefore follow that it is convertible into pure elementary fire. This, for aught that appears, may be ingenerable and incorruptible by the course of nature[1]. It may be fixed and imprisoned in a compound (sect. 169, 192, 193), and yet retain its nature, though lost to sense, and though it return into the invisible elementary mass, upon the analysis of the compounded body: as is manifest in the solution of stone lime by water.

199. It should seem, therefore, that what is said of air's

[1] As held by the younger Lemery, to whom Berkeley afterwards refers (sect. 244).

being the pabulum of fire, or being converted into fire, ought to be understood only in this sense; to wit, that air, being less gross than other bodies, is of a middle nature, and therefore more fit to receive the impressions of a fine æthereal fire (sect. 163), and impart them to other things. According to the ancients, soul serveth for a vehicle to intellect (sect. 178), and light or fire for a vehicle to the soul; and, in like manner, air may be supposed a vehicle to fire, fixing it in some degree, and communicating its effects to other bodies.

200. The pure invisible fire or æther doth permeate all bodies, even the hardest and most solid, as the diamond. This alone, therefore, cannot, as some learned men have supposed, be the cause of muscular motion, by a mere impulse of the nerves communicated from the brain to the membranes of the muscles, and thereby to the enclosed æther, whose expansive motion, being by that means increased, is thought to swell the muscles and cause a contraction of the fleshy fibres. This, it should seem, the pure æther cannot do immediately and of itself, because, supposing its expansive motion to be increased, it must still pass through the membranes, and consequently not swell them, inasmuch as æther is supposed freely to pervade the most solid bodies. It should seem, therefore, that this effect must be owing, not to pure æther, but to æther in some part fixed and arrested by the particles of air.

201. Although this æther be extremely elastic, yet, as it is sometimes found by experience to be attracted, imprisoned, and retained in gross bodies (sect. 169), so we may suppose it to be attracted, and its expansive force diminished, though it should not be quite fixed, by the loose particles of air, which combining and cohering therewith may bring it down, and qualify it for intercourse with grosser things. Pure fire may be said to animate air, and air other things. Pure fire is invisible; therefore flame is not pure fire. Air is necessary both to life and flame. And it is found by experiment that air loseth in the lungs the power of feeding flame. Hence it is concluded that the same thing in air contributes both to life and flame. Vital flame survives culinary flame in vacuo: therefore it requires less of that thing to sustain it.

202. What this may be, whether some certain proportion, or some peculiar parts, of æther, is not easy to say. But thus much seems plain, that whatever is ascribed to acid may be also ascribed to fire or æther. The particles of æther fly asunder with the greatest force: therefore, agreeably to Sir Isaac Newton's doctrine, when united they must attract each other with the greatest force. Therefore they constitute the acid. For, whatsoever strongly attracts and is attracted, may be called an acid, as Sir Isaac Newton informs us in his tract *De Acido*. Hence it should seem that the sulphur of Homberg, and the acid of Sir Isaac are at bottom one and the same thing, to wit, pure fire or æther.

203. The vital flame or æthereal spirit, being attracted and imprisoned in grosser bodies, seemeth to be set free and carried off by the superior attraction of a subtle and pure flame. Hence, perhaps, it is, that lightning kills animals, and turns spirituous liquors vapid in an instant.

204. Hippocrates, in his book concerning the Heart[1], observeth that the soul of man is not nourished by meats and drinks from the lower belly, but by a pure and luminous substance darting its rays, and distributing a non-natural nourishment, as he terms it, in like manner as that from the intestines is distributed to all parts of the body. This luminous non-natural nourishment, though it be secreted from the blood, is expressly said not to come from the lower belly. It is plain, therefore, he thought it came into the blood, either by respiration, or by attraction through the pores. And it must be acknowledged that somewhat igneous or æthereal, brought by the air into the blood, seems to nourish, though not the soul itself, yet the interior tunicle of the soul, the *auraï simplicis ignem*.

205. That there is really such a thing as vital flame, actually kindled, nourished, and extinguished, like common flame, and by the same means, is an opinion of some moderns, particularly of Dr. Willis[2] in his tract *De San-*

[1] *Opera*, tom. I. p. 490.

[2] Thomas Willis (1621–1675), called by Anthony Wood 'the most celebrated physician of his time,' author of the *De Anima Brutorum*. There are several editions of his collected works. The tract here referred to is entitled *De Sanguinis Incalescentia, sive Accensione*.

guinis Accensione: that it requires constant eventilation, through the trachæa and pores of the body for the discharge of a fuliginous and excrementitious vapour; and that this vital flame, being extremely subtle, might not be seen any more than shining flies or *ignes fatui* by daylight. And yet it hath sometimes become visible on divers persons, of which there are undoubted instances. This is Dr. Willis's notion: and perhaps there may be some truth in this, if it be so understood as that light or fire might indeed constitute the animal spirit or immediate vehicle of the soul.

206. There have not been wanting those, who, not content to suppose Light the most pure and refined of all corporeal beings, have gone farther, and bestowed upon it some attributes of a yet higher nature[1]. Julianus, the Platonic philosopher, as cited by Ficinus, saith it was a doctrine in the theology of the Phœnicians, that there is diffused throughout the universe a pellucid and shining nature, pure and impassive, the act of a pure intelligence. And Ficinus himself undertakes to prove that light is incorporeal by several arguments: because it enlightens and fills a great space in an instant, and without opposition: because several lights meet without resisting each other: because light cannot be defiled by filth of any kind: because the solar light is not fixed in any subject: lastly, because it contracts and expands itself so easily without collision, condensation, rarefaction, or delay, throughout the vastest space. These reasons are given by Ficinus, in his comment on the first book[2] of the second Ennead of Plotinus.

207. But it is now well known that light moves, and that its motion is not instantaneous: that it is capable of condensation, rarefaction, and collision: that it can be mixed with other bodies, enter their composition, and increase their weight (sect. 169, 192, 193). All which seems sufficiently to overthrow those arguments of Ficinus, and shew light to be corporeal. There appears indeed some difficulty at first sight, about the non-resistance of

[1] Light or Fire is considered in yet other aspects in sect. 206–211—in particular in regard to its alleged incorporeality, which Berkeley denies.

[2] Cap. 3.

rays or particles of light occurring one to another, in all possible directions or from all points. Particularly, if we suppose the hollow surface of a large sphere studded with eyes looking inwards one at another, it may perhaps seem hard to conceive how distinct rays from every eye should arrive at every other eye without justling, repelling, and confounding each other.

208. But these difficulties may be got over by considering, in the first place, that visible points are not mathematical points[1], and consequently that we are not to suppose every point of space a radiating point. Secondly, by granting that many rays do resist and intercept each other, notwithstanding which the act of vision may be performed. Since as every point of the object is not seen, so it is not necessary that rays from every such point arrive at the eye. We often see an object, though more dimly, when many rays are intercepted by a gross medium.

209. Besides, we may suppose the particles of light to be indefinitely small, that is, as small as we please, and their aggregate to bear as small a proportion to the void as we please, there being nothing in this that contradicts the phænomena. And there needs nothing more, in order to conceive the possibility of rays passing from and to all visible points, although they be not incorporeal. Suppose a hundred ports placed round a circular sea, and ships sailing from each port to every other; the larger the sea, and the smaller the vessels are supposed, the less danger will there be of their striking against each other. But, as there is by hypothesis no limited proportion between the sea and the ships, the void and solid particles of light, so there is no difficulty that can oblige us to conclude the sun's light incorporeal from its free passage; especially when there are so many clear proofs of the contrary. As for the difficulty, therefore, attending the supposition of a sphere studded with eyes looking at each other, this is removed only by supposing the particles of light exceeding small relatively to the empty spaces.

210. Plotinus[2] supposeth that from the sun's light, which is corporeal, there springs forth another equivocal light

[1] Cf. *New Theory of Vision*, sect. 150–152.

[2] See *Second Ennead*, Lib. I. c. 7, in the Commentary of Ficinus; also *Timæus*, pp. 45, 55–56.

which is incorporeal, and as it were the brightness of the former. Marcilius Ficinus[1] also, observing it to be a doctrine in the *Timæus* of Plato, that there is an occult fire or spirit diffused throughout the universe, intimates that this same occult invisible fire or light is, as it were, the sight of the mundane soul. And Plotinus in his fourth Ennead[1] sheweth it to be his opinion that the world seeth itself and all its parts. The Platonic philosophers do wonderfully refine upon light, and soar very high: from coal to flame; from flame to light; from this visible light to the occult light of the celestial or mundane soul, which they supposed to pervade and agitate the substance of the universe by its vigorous and expansive motion.

211. If we may believe Diogenes Laertius[2], the Pythagorean philosophers thought there was a certain pure heat or fire, which had somewhat Divine in it, by the participation whereof men became allied to the gods. And according to the Platonist, heaven is not defined so much by its local situation as by its purity. The purest and most excellent fire, that is heaven, saith Ficinus[3]. And again, the hidden fire that everywhere exerts itself, he calls celestial. He represents fire as most powerful and active, dividing all things, abhorring all composition or mixture with other bodies. And, as soon as it gets free, relapsing instantly into the common mass of celestial fire, which is everywhere present and latent.

212. This[4] is the general source of life, spirit, and strength, and therefore of health to all animals, who constantly receive its illapses clothed in air, through the lungs and pores of the body. The same spirit, imprisoned in food and medicines, is conveyed into the stomach, the bowels, the lacteals, circulated and secreted by the several ducts, and distributed throughout the system (sect. 37, 42, 44). Plato, in his *Timæus*[5], enumerating the ignited juices, names wine in the first place, and tar in the second. But wine is pressed from the grape, and fermented by human industry. Therefore of all ignited juices purely natural, tar or resin must in his account be esteemed the first.

[1] Lib. V. c. 8.
[2] Diog. Laert. Lib. VIII. p. 585.
[3] Ficinus on *Second Ennead*, Lib. I.
[4] Sect. 212-219 sum up the doctrine of *Siris* regarding the relations of the invisible Fire to animal and vegetable Life.
[5] P. 60.

213. The vivifying luminous æther exists in all places, even the darkest caverns; as is evident from hence, that many animals see in those dark places, and that fire may be kindled in them by the collision or attrition of bodies. It is also known that certain persons have fits of seeing in the dark. Tiberius was said[1] to have had this faculty or distemper. I myself knew an ingenious man who had experienced it several times in himself. And Dr. Willis, in his tract *De Sanguinis Accensione*, mentions another of his own knowledge. This luminous æther or spirit is therefore said by Virgil[2] to nourish or cherish the innermost earth, as well as the heavens and celestial bodies.

> 'Principio cœlum ac terras, camposque liquentes,
> Lucentemque globum Lunæ, Titaniaque astra
> Spiritus intus alit.'

214. The principles of motion and vegetation in living bodies seem to be delibations from the invisible fire or spirit of the universe (sect. 43, 157, 164, 171): which though present to all things, is not nevertheless one way received by all; but variously imbibed, attracted, and secreted, by the fine capillaries, and exquisite strainers in the bodies of plants and animals, whereby it becomes mixed and detained in their juices.

215. It hath been thought by some observers of nature that the fine glandular vessels admit from the common mass of the blood only such juices as are homogeneous to those with which they were originally imbued. How they came to be so imbued doth not appear. But thus much is plain; that fine tubes attract fluids, that the glands are fine tubes, and that they attract very different juices from the common mass. The same holds also with regard to the capillary vessels of vegetables (sect. 30, 31, 33, 35), it being evident that, through the fine strainers in the leaves and all over the body of the plant, there be juices or fluids of a particular kind drawn in, and separated from the common mass of air and light. And that the most elaborate spirit, whereon the character or distinguishing virtue and properties of the plant depend, is of a luminous (sect. 37, 43) and volatile nature, being lost or escaping into air

[1] *Suetonius*, cap. 68. [2] *Æneid*, VI. 724-26.

or æther, from essential oils and odoriferous waters, without any sensible diminution of them.

216. As different kinds of secreted light or fire produce different essences, virtues, or specific properties, so also different degrees of heat produce different effects. Thus, one degree of heat keeps the blood from coagulating, and another degree coagulates the blood. Thus, a more violent fire hath been observed to set free and carry off that very light, which a more moderate fire had introduced and fixed in the calcined regulus of antimony. In like manner, one kind or quantity of this æthereal fiery spirit may be congenial and friendly to the spirits of a man, while another may be noxious.

217. And experience sheweth this to be true[1]. For, the fermented spirit of wine or other liquors produceth irregular motions, and subsequent depressions in the animal spirits. Whereas the luminous spirit lodged and detained in the native balsam of pines and firs is of a nature so mild, and benign, and proportioned to the human constitution, as to warm without heating, to cheer but not inebriate[2], and to produce a calm and steady joy like the effect of good news, without that sinking of spirits which is a subsequent effect of all fermented cordials. I may add, without all other inconvenience, except that it may like any other medicine be taken in too great a quantity for [[3]a nice] stomach. In which case it may be right to lessen the dose, or to take it only once in the four and twenty hours, empty, going to bed (when it is found to be least offensive), or even to suspend the taking of it for a time, till nature shall seem to crave it, and rejoice in its benign and comfortable spirit.

218. Tar-water, serving as a vehicle to this spirit, is both diuretic and diaphoretic, but seems to work its

[1] The train of thought here (sect. 217–219) returns to the medical and other properties of tar-water.

[2] So Cowper—

> . . . . 'The cups,
> That cheer but not inebriate, wait on each;
> So let us welcome peaceful evening in.'

The Task, Bk. IV. 39. The coincidence can hardly be accidental. Cowper, born in 1731, was grown up when *Siris* was the rage—for its therapeutic novelties and proposed Panacea.

[3] 'too nice a'—in first edition.

principal effect by assisting the *vis vitæ*, as an alterative and cordial, enabling nature, by an accession of congenial spirit, to assimilate that which could not be assimilated by her proper force, and so to subdue the *fomes morbi*. And this should seem in most cases the best and safest course. Great evacuations weaken nature as well as the disease. And it is to be feared that they who use salivations and copious bleedings, may, though they should recover of the distemper, in their whole life be never able to recover of the remedies.

219. It is true, indeed, that in chronical cases there is need of time to complete a cure; and yet I have known this tar-water in disorders of the lungs and stomach to prove a very speedy remedy, and to allay the anxiety and heat of a fever in an instant, giving ease and spirits to the patient. This I have often experienced, not without surprise at seeing these salutary effects follow so immediately in a fever on taking a glass of tar-water. Such is the force of these active vivifying principles contained in this balsam.

220. Force or power, strictly speaking, is in the Agent alone who imparts an equivocal force to the invisible elementary fire, or animal spirit of the world (sect. 153, 156, 157); and this to the ignited body or visible flame, which produceth the sense of light and heat[1]. In this chain the first and last links[2] are allowed to be incorporeal: the two intermediate[3] are corporeal, being capable of motion, rarefaction, gravity, and other qualities of bodies. It is fit to distinguish these things, in order to avoid ambiguity concerning the nature of fire.

221. Sir Isaac Newton, in his *Optics*[4], asks, Is not fire a body heated so hot as to emit light copiously? for what else, adds he, is a red-hot iron than fire? Now, it should

[1] In sect. 220–230, Berkeley, criticising Newtonian theories of Light and elastic Æther, recalls the pervading thought of his own philosophy—its ultimate reference of all proper efficiency in the universe to living and ever realising Mind. He distinguishes the spiritual from the corporeal or symbolical links in the Universal Chain; also Fire from the invisible effects; and the Newtonian from his own fiery Æther.

[2] i. e. the Supreme Agent, and the sentient intelligence.

[3] i. e. the invisible Fire, and the visible flame.

[4] Bk. III. Qu. 9.

seem that to define fire by heat would be to explain a thing by itself. A body heated so hot as to emit light is an ignited body; that is, hath fire in it, is penetrated and agitated by fire, but is not itself fire. And although it should in the third foregoing acceptation, or vulgar sense[1], pass for fire, yet it is not the pure elementary fire (sect. 190) in the second or philosophic sense—such as was understood by the sages of antiquity, and such as is collected in the focus of a burning-glass; much less is it the *vis*, force, or power of burning, destroying, calcining, melting, vitrifying, and raising the perceptions of light and heat: this is truly and really in the incorporeal Agent, and not in the vital spirit of the universe. Motion, and even power in an equivocal sense, may be found in this pure æthereal spirit, which ignites bodies, but is not itself the ignited body; being an instrument or medium by which the real agent (sect. 160) doth operate on grosser bodies.

222. It hath been shewed in Sir Isaac Newton's *Optics*[2], that light is not reflected by impinging on bodies, but by some other cause. And to him it seems probable that as many rays as impinge on the solid parts of bodies are not reflected, but stifled and retained in the bodies. And it is certain the great porosity of all known bodies affords room for much of this light or fire to be lodged therein. Gold itself, the most solid of all metals, seems to have far more pores than solid parts, from water being pressed through it in the Florentine experiment, from magnetic effluvia passing, and from mercury entering, its pores so freely. And it is admitted that water, though impossible to be compressed, hath at least forty times more pores than solid parts. And, as acid particles, joined with those of earth in certain proportions, are so closely united with them as to be quite hid and lost to all appearance, as in *mercurius dulcis* and common sulphur, so also may we conceive the particles of light or fire to be absorbed and latent in grosser bodies.

223. It is the opinion of Sir Isaac Newton that somewhat unknown remains *in vacuo*, when the air is exhausted. This unknown medium he calls æther[3]. He supposeth

[1] i. e. as visible flame.

[2] Bk. II. Prop. 8.

[3] In his *Letter to Mr. Boyle on the Cause of Gravitation* (Feb. 28,

it to be more subtle in its nature, and more swift in its motion, than light, freely to pervade all bodies, and by its immense elasticity to be expanded throughout all the heavens. Its density is supposed greater in free and open spaces than within the pores of compact bodies. And in passing from the celestial bodies to great distances, it is supposed to grow denser and denser continually; and thereby cause those great bodies to gravitate towards one another, and their respective parts towards their centres, every body endeavouring to pass from the denser parts of the medium towards the rarer.

224. The extreme minuteness of the parts of this medium, and the velocity of their motion, together with its gravity, density, and elastic force, are thought to qualify it for being the cause of all the natural motions in the universe. To this cause are ascribed the gravity and cohesion of bodies. The refraction of light is also thought to proceed from the different density and elastic force of this æthereal medium in different places. The vibrations of this medium, alternately concurring with, or obstructing the motions of the rays of light, are supposed to produce the fits of easy reflection and transmission. Light by the vibrations of this medium is thought to communicate heat to bodies. Animal motion and sensation are also accounted for by the vibrating motions of this æthereal medium, propagated through the solid capillaments of the nerves. In a word, all the phænomena and properties of bodies, that were before attributed to attraction, upon later thoughts seem ascribed to this æther, together with the various attractions themselves.

225. But, in the philosophy of Sir Isaac Newton, the fits (as they are called) of easy transmission and reflexion seem as well accounted for by vibrations excited in bodies by the rays of light, and the refraction of light by the attraction of bodies. To explain the vibrations of light by

1679), Newton thus propounds his hypothesis of an *elastic* Æther: —'And first I suppose there is diffused through all places an æthereal substance, capable of contraction or dilation, strongly elastic; in a word, much like air in all respects, but far more subtle. I suppose this Æther pervades all gross bodies, but yet so as to stand rarer in their pores than in free places; and so much the rarer as their pores are less. And this I suppose to be the cause,' &c. (*Opera*, vol. IV. pp. 384–394). Cf. *Optics*, Bk. III. Qu. 18–23.

those of a more subtle medium seems an uncouth explication. And gravity seems not an effect of the density and elasticity of æther, but rather to be produced by some other cause: which Sir Isaac himself insinuates [1] to have been the opinion even of those ancients who took vacuum, atoms, and the gravity of atoms, for the principles of their philosophy; tacitly attributing (as he well observes) gravity to some other cause distinct from matter, from atoms, and consequently from that homogeneous æther or elastic fluid. The elasticity of which fluid is supposed to depend upon, to be defined and measured by, its density; and this by the quantity of matter in one particle, multiplied by the number of particles contained in a given space; and the quantity of matter in any one particle [2 or body of a given size] to be determined by its gravity. Should not therefore gravity seem the original property and first supposed? On the other hand, if force be considered as prescinded from gravity and matter, and as existing only in points or centres [3], what can this amount to but an abstract, spiritual, incorporeal force?

226. It doth not seem necessary, from the phænomena, to suppose any medium more active and subtle than light or fire. Light being allowed to move at the rate of about ten millions of miles in a minute, what occasion is there to conceive another medium of still smaller and more moveable parts? Light or fire seems the same with æther. So the ancients understood, and so the Greek word implies. It pervades all things (sect. 157), is everywhere present. And this same subtle medium, according to its various quantities, motions, and determinations, sheweth itself in different effects or appearances, and is æther, light, or fire.

227. The particles of æther fly asunder with the greatest force; therefore when united they must (according to the Newtonian doctrine) attract each other with the greatest force; therefore they are acids, or constitute the acid (sect. 130); but this united with earthy parts maketh alkali, as Sir Isaac teacheth in his tract *De Acido* [4]: alkali, as

[1] *Optics*, Bk. III. Qu. 28. See also Clarke's *Fifth Reply* to Leibniz.

[2] In the early editions.

[3] As in Boscovich's theory, and in some recent speculations, e. g. *The World Dynamical and Immaterial* (1868), by R. S. Wyld.

[4] Newton, *De Natura Acidorum*. See sect. 126, note 2.

appears in cantharides and lixivial salts, is a caustic; caustics are fire; therefore acid is fire; therefore æther is fire; and if fire, light. We are not therefore obliged to admit a new medium distinct from light, and of a finer and more exquisite substance, for the explication of phænomena which appear to be as well explained without it. How can the density or elasticity of æther account for the rapid flight of a ray of light from the sun, still swifter as it goes farther from the sun? Or how can it account for the various motions and attractions of different bodies? Why oil and water, mercury and iron, repel, or why other bodies attract each other? Or why a particle of light should repel on one side and attract on the other, as in the case of the Islandic crystal? To explain cohesion by hamate atoms is accounted *ignotum per ignotius*. And is it not as much so to account for the gravity of bodies by the elasticity of æther?

228. It is one thing to arrive at general laws of nature from a contemplation of the phænomena; and another to frame an hypothesis, and from thence deduce the phænomena. Those who suppose epicycles, and by them explain the motions and appearances of the planets, may not therefore be thought to have discovered principles true in fact and nature. And, albeit we may from the premises infer a conclusion, it will not follow that we can argue reciprocally, and from the conclusion infer the premises. For instance, supposing an elastic fluid, whose constituent minute particles are equidistant from each other, and of equal densities and diameters, and recede one from another with a centrifugal force which is inversely as the distance of the centres; and admitting that from such supposition it must follow that the density and elastic force of such fluid are in the inverse proportion of the space it occupies when compressed by any force; yet we cannot reciprocally infer that a fluid endued with this property must therefore consist of such supposed equal particles: for it would then follow that the constituent particles of air were of equal densities and diameters; whereas it is certain that air is an heterogeneous mass, containing in its composition an infinite variety of exhalations, from the different bodies which make up this terraqueous globe.

229. The phænomena of light, animal spirit, muscular motion, fermentation, vegetation, and other natural operations, seem to require nothing more than the intellectual and artificial fire of Heraclitus, Hippocrates, the Stoics (sect. 166, 168), and other ancients. Intellect, superadded to æthereal spirit, fire, or light, moves, and moves regularly; proceeding in a method, as the Stoics, or increasing and diminishing by measure, as Heraclitus expressed it. The Stoics held that fire comprehended and included the spermatic reasons or forms (λόγους σπερματικούς) of all natural things. As the forms of things have their ideal existence in the intellect, so it should seem that seminal principles have their natural existence in the light (sect. 164); a medium consisting of heterogeneous parts, differing from each other in divers qualities that appear to sense, and not improbably having many original properties, attractions, repulsions, and motions, the laws and natures whereof are indiscernible to us, otherwise than in their remote effects. And this animated heterogeneous fire should seem a more adequate cause, whereby to explain the phænomena of nature, than one uniform æthereal medium.

230. Aristotle, indeed, excepts against the elements being animated. Yet nothing hinders why that power of the soul styled by him κινητική, or locomotive[1], may not reside therein, under the direction of an Intellect, in such sense and as properly as it is said to reside in animal bodies. It must nevertheless be owned, that albeit that philosopher acknowledgeth a Divine force or energy in fire, yet to say that fire is alive, or that having a soul it should not be alive, seem to him equally absurd. See his second book *De Partibus Animalium*[2].

231. [3] The laws of attraction and repulsion are to be

[1] Cf. sect. 153.

[2] Cap. 3. See also the *De Anima*, Lib. I. c. 5, where Aristotle seems to reject the supposition (adopted partly to explain perception) that the principle of Life (ψυχή) is diffused through the universe; or at least to deny that if an animated Fire or Air were so diffused, it could be identified with the Life to which animal motion is referred.

[3] Sect. 231–54 reject the 'corpuscularian,' or mechanical, conception of attraction, as well as the Newtonian hypothesis of an elastic Æther (insufficient even as a physical explanation), as no ultimate

regarded as laws of motion; and these only as rules or methods observed in the productions of natural effects, the efficient and final causes whereof are not of mechanical consideration. Certainly, if the explaining a phænomenon be to assign its proper efficient and final cause (sect. 154, 155, 160), it should seem the mechanical philosophers never explained any thing; their province being only to discover the laws of nature, that is, the general rules and methods of motion; and to account for particular phænomena by reducing them under, or shewing their conformity to, such general rules.

232. Some corpuscularian philosophers of the last age have indeed attempted to explain the formation of this world and its phænomena by a few simple laws of mechanism. But, if we consider the various productions of nature, in the mineral, vegetable, and animal parts of the creation, I believe we shall see cause to affirm, that not any one of them has hitherto been, or can be, accounted for, on principles merely mechanical; and that nothing could be more vain and imaginary than to suppose with Descartes, that merely from [[1]a circular motion's] being impressed by the Supreme Agent on the particles of extended substance, the whole world, with all its several parts, appurtenances, and phænomena, might be produced, by a necessary consequence, from the laws of motion.

233. Others suppose that God did more at the beginning; having then made the seeds of all vegetables and animals, containing their solid organical parts in miniature, the gradual filling and evolution[2] of which, by the influx

account of Nature; inasmuch as *being perceived*, and *being moved by spiritual agency*, are two necessary implicates of concrete reality. Berkeley, like Plato, recognises Mind as Agent in all motion; but he does not attribute motion to mind. Like Plato, too, in the *Timæus*, he distinguishes vital Fire, and universally animating Soul, from Supreme Eternal Mind. The interpolated medium, like the Plastic Nature of Cudworth, may be due to a tendency (of which in his early writings Berkeley shews no sign), first to assume, and then to try to bridge over, a chasm between Divine Reason or Will and the data of the senses.

[1] 'Circular motions'—in the first edition. He alludes to the vortices of Descartes; which that philosopher held conjoined with faith in constant Divine causation—not a pre-established harmony.

[2] 'evolution,' i. e. divinely regulated evolution, the conception of which is in harmony with the philosophy involved in *Siris*.

of proper juices, doth constitute the generation and growth of a living body. So that the artificial structure of plants and animals daily generated requires no present exercise of art to produce it, having been already framed at the origin of the world, which with all its parts hath ever since subsisted; going like a clock or machine by itself, according to the laws of nature, without the immediate hand of the artist[1]. But how can this hypothesis explain the blended features of different species in mules and other mongrels? or the parts added or changed, and sometimes whole limbs lost, by marking in the womb? or how can it account for the resurrection of a tree from its stump, or the vegetative power in its cuttings? in which cases we must necessarily conceive something more than the mere evolution of a seed.

234. Mechanical laws of nature or motion direct us how to act, and teach us what to expect. Where intellect presides there will be method and order, and therefore rules, which if not stated and constant would cease to be rules. There is therefore a constancy in things, which is styled the Course of Nature[2] (sect. 160). All the phænomena in nature are produced by motion[3]. There appears an uniform working in things great and small, by attracting and repelling forces. But the particular laws of attraction and repulsion are various. Nor are we concerned at all about the forces, neither can we know or measure them otherwise than by their effects, that is to say, the motions; which motions only, and not the forces, are indeed in the bodies (sect. 155). Bodies are moved to or from each other, and this is performed according to different laws. The natural or mechanic philosopher endeavours to dis-

[1] As in Leibniz's theory of an *original* Providence, instead of a *constant* Providence. See the *Collection of Papers* between Leibniz and Samuel Clarke (pp. 4, 26-34, &c., which seems to be here in Berkeley's eye). So, too, in recent theories of cosmical evolution. Perhaps the question, which concerns the relations of the Universal Mind to time and change, is indeterminable by human intelligence.

[2] Faith or trust in the absolute supremacy of Active Reason in the universe explains our disposition to presuppose the constancy of natural order. The working force exemplified in the laws of the material world is accordingly divine, and nature is potentially supernatural.

[3] i.e. are, sensibly considered, resolvable into laws of motion, exemplified in the data of sense.

cover those laws by experiment and reasoning. But what is said of forces residing in bodies, whether attracting or repelling, is to be regarded only as a mathematical hypothesis, and not as any thing really existing in nature[1].

235. We are not therefore seriously to suppose, with certain mechanic philosophers, that the minute particles of bodies have real forces or powers, by which they act on each other, to produce the various phænomena in nature. The minute corpuscles are impelled and directed, that is to say, moved to and from each other, according to various rules or laws of motion. The laws of gravity, magnetism, and electricity are divers. And it is not known what other different rules or laws of motion might be established by the Author of nature. Some bodies approach together, others fly asunder, and perhaps some others do neither. When salt of tartar flows *per deliquium*, it is visible that the particles of water floating in the air are moved towards the particles of salt, and joined with them. And when we behold vulgar salt not to flow *per deliquium*, may we not conclude that the same law of nature and motion doth not obtain between its particles and those of the floating vapours? A drop of water assumes a round figure, because its parts are moved towards each other. But the particles of oil and vinegar have no such disposition to unite. And when flies walk in water, without wetting their feet, it is attributed to a repelling force or faculty in the flies' feet. But this is obscure, though the phænomenon be plain[2].

236. It is not improbable, and seems not unsupported by experiments, that, as in algebra, where positive quantities cease there negative begin, even so in mechanics, where attracting forces cease there repelling forces begin: or (to express it more properly) where bodies cease to be

[1] Cf. *De Motu*, sect. 67–70. Even if all changes in nature could be resolved by us under their natural laws of motion, the *laws* would be only effects, not the responsible Cause. The Active Reason that is omnipresent in all the laws of motions cannot be an effect of the motions themselves in which it is revealed.

[2] The so-called *arbitrariness* of the existing constitution of visible nature means its dependence, not on caprice, but on perfectly reasonable Will. It implies the ultimate dependence of the physical world upon the moral world, and so the ethical root of the Whole.

moved towards, they begin to be moved from each other. This Sir Isaac Newton infers from the production of air and vapours, whose particles fly asunder with such vehement force. We behold iron move towards the loadstone, straws towards amber, heavy bodies towards the earth. The laws of these motions are various. And when it is said that all the motions and changes in the great world arise from attraction—the elasticity of the air, the motion of water, the descent of heavy, and the ascent of light bodies, being all ascribed to the same principle; when from insensible attractions of most minute particles at the smallest distance are derived cohesion, dissolution, coagulation, animal secretion, fermentation, and all chemical operations; and when it is said that without such principles there never would have been any motion in the world, and without the continuance thereof all motion would cease; in all this we know or understand no more than that bodies are moved according to a certain order, and that they do not move themselves.

237. So likewise, how to explain all those various motions and effects, by the density and elasticity of æther, seems incomprehensible (sect. 153, 162). For instance, why should the acid particles draw those of water and repel each other? Why should some salts attract vapours in the air, and others not? Why should the particles of common salt repel each other, so as not to subside in water? Why should the most repellent particles be the most attractive upon contact? Or why should the repellent begin where the attractive faculty leaves off? These, and numberless other effects, seem inexplicable on mechanical principles; or otherwise than by recourse to a mind or spiritual agent (sect. 154, 220). Nor will it suffice from present phænomena and effects, through a chain of natural causes and subordinate blind agents, to trace a Divine Intellect as the remote[1] original cause, that first created the world, and then set it a going. We cannot make even one single step in accounting for the phænomena, without admitting the immediate presence and immediate action of an incorporeal agent, who connects, moves, and disposes

[1] Cf. the *Vindication of the New Theory of Vision*, which is charged with the conception of a sensibly manifested continuous Divine Providence, as contrasted with Epicurean agnosticism.

all things, according to such rules, and for such purposes, as seem good to him[1].

238. It is an old opinion, adopted by the moderns, that the elements and other natural bodies are changed each into other (sect. 148). Now, as the particles of different bodies are agitated by different forces, attracting and repelling, or, to speak more accurately, are moved by different laws, how can these forces or laws be changed, and this change accounted for by an elastic æther? Such a medium—distinct from light or fire—seemeth not to be made out by any proof, nor to be of any use in explaining the phænomena. But if there be any medium employed, as a subordinate cause or instrument in attraction, it would rather seem to be light (sect. 152, 156); since, by an experiment of Mr. Boyle's[2], amber, that shewed no sign of attraction in the shade, being placed where the sunbeams shone upon it, immediately attracted light bodies. Besides, it hath been discovered by Sir Isaac Newton[3], and an admirable discovery it was, that light is an heterogeneous medium, consisting of particles endued with original distinct properties (sect. 40, 181). And upon these, if I may venture to give my conjectures, it seemeth probable the specific properties of bodies, and the force of specific medicines, may depend[4]. Different sides of the same ray shall, one approach and the other recede from the Islandic crystal; can this be accounted for by the elasticity of a fine medium, or by the general laws of motion, or by any mechanical principles whatever? And if not, what should hinder but there may be specific medicines, whose operation depends not upon mechanical principles, how much soever that notion hath been exploded of late years?

239. Why may we not suppose certain idiosyncrasies, sympathies, oppositions, in the solids, or fluids, or animal spirit of a human body, with regard to the fine insensible

[1] No originating or responsible causes are found among the passive data of the senses. There is implied the agency of the Universal Power, and also of individual persons, who are free to do evil.

[2] See Boyle's *Works*, vol. V. p. 265.

[3] See *Optics*, Bk. I. Prop. 4.

[4] i. e. as their ultimate *physical cause* or *natural sign*. He takes Fire or Light, for these reasons, as scientifically preferable to elastic æther. Cf. sect. 217-219.

parts of minerals or vegetables, impregnated by rays of light of different properties; not depending on the different size, figure, number, solidity, or weight of those particles, nor on the general laws of motion, nor on the density or elasticity of a medium, but merely and altogether on the good pleasure of the Creator, in the original formation of things? From whence divers unaccountable and unforeseen motions may arise in the animal economy; from whence also various peculiar and specific virtues may be conceived to arise, residing in certain medicines, and not to be explained by mechanical principles. For, although the general known laws of motion are to be deemed mechanical, yet peculiar motions of the insensible parts, and peculiar properties depending thereon, are occult and specific.

240. The words attraction and repulsion may, in compliance with custom, be used where, accurately speaking, motion alone is meant. And in that sense it may be said that peculiar attractions or repulsions in the parts are attended with specific properties in the whole. The particles of light are vehemently moved to or from, retained, or rejected by, objects: which is the same thing as to say, with Sir Isaac Newton, that the particles of acids are endued with great attractive force (sect. 202), wherein their activity consists; whence fermentation and dissolution; and that the most repellent are, upon contact, the most attracting particles.

241. Gravity and fermentation are received for two most extensive principles. From fermentation are derived the motion and warmth of the heart and blood in animals, subterraneous heat, fires, and earthquakes, meteors, and changes in the atmosphere. And that attracting and repelling forces operate in the nutrition and dissolution of animal and vegetable bodies is the doctrine both of Hippocrates and Sir Isaac Newton. The former of these celebrated authors, in his Treatise concerning Diet or Regimen[1], observes that in the nourishment of man, one part repels and another attracts. And again in the same Treatise[2], two carpenters, saith he, saw a piece of timber: one draws, the other pushes: these two actions tend to one

[1] *Opera*, vol. I. p. 636 (ed. Lips. 1825). [2] *Ibid.* p. 642.

and the same end, though in a contrary direction, one up, the other down: this imitates the nature of man: *πνεῦμα τὸ μὲν ἕλκει τὸ δὲ ὠθέει.*

242. It is the general maxim of Hippocrates, that the manner wherein nature acts consisteth in attracting what is meet and good, and in repelling what is disagreeable or hurtful. He makes the whole of the animal economy to be administered by the faculties or powers of nature. Nature alone, saith he, sufficeth for all things to animals. She knows of herself what is necessary for them. Whence it is plain he means a conscious intelligent Nature, that presides and moves the æthereal spirit. And though he declares all things are accomplished on man by necessity, yet it is not a blind fate, or chain of mere corporeal causes, but a Divine Necessity, as he himself expressly calls it[1]. And what is this but an overruling Intelligent Power that disposeth of all things?

243. Attraction cannot produce, and in that sense account for, the phænomena, being itself one of the phænomena produced and to be accounted for (sect. 160, 235). Attraction is performed by different laws, and cannot therefore in all cases be the effect of the elasticity of one uniform medium. The phænomena of electrical bodies, the laws and variations of magnetism, and, not to mention other kinds, even gravity, are not explained by elasticity, a phænomenon not less obscure than itself. But then, although it shew not the Agent, yet it sheweth a rule and analogy in nature, to say, that the solid parts of animals are endued with attractive powers whereby from contiguous fluids they draw like to like; and that glands have peculiar powers attractive of peculiar juices (sect. 41). Nature seems better known and explained[2] by attractions and repulsions, than by those other mechanical principles of size, figure, and the like; that is, by Sir Isaac Newton, than Descartes. And natural philosophers excel, as they

[1] *Opera*, I. pp. 639–41; also p. 633. This notion of a *divine* necessity (*ἀνάγκη θεία*), distinguished from *blind* fate, was common among the Greeks. See e. g. Plato, *Timæus*, pp. 47, 48; Ps.-Plutarch, *De Placit. Philos.* Lib. I. c. 25, 26. Cf. Arist. *Metaph.* Lib. IV. c. 5, and the Ps. *De Mundo*, c. 6.

[2] i. e. in a merely *physical* explanation; which gives, not causation proper, but only signs and their significations, or, as we say, *natural laws.*

are more or less acquainted with the laws and methods observed by the Author of nature[1].

244. The size and shape of particles and general laws of motion can never explain the secretions, without the help of attraction, obscure perhaps as to its cause, but clear as a law. Numberless instances of this might be given. Lemery the younger[2] thought himself obliged to suppose the particles of light or fire (contrary to all reason) to be of a very gross kind, even greater than the pores of the burnt limestone, in order to account for their being detained or imprisoned therein; but this phænomenon is easily reduced to attraction. There would be no end of enumerating the like cases. The activity and force of æthereal spirit or fire, by the laws of attraction, is imparted to grosser particles (sect. 152, 163), and thereby wonderfully supports the economy of living bodies. By such peculiar compositions and attractions, it seems to be effected that denser fluids can pass where air itself cannot (as oil through leather), and therefore through the nicest and finest strainers of an animal or vegetable.

245. The ancients had some general conception of attracting and repelling powers (sect. 241, 242) as natural principles. Galilæi had particularly considered the attraction of gravity, and made some discovery of the laws thereof. But Sir Isaac Newton, by his singular penetration, profound knowledge in geometry and mechanics, and great exactness in experiments, hath cast a new light on natural science. The laws of attraction and repulsion were in many instances discovered, and first discovered, by him. He shewed their general extent; and therewith, as with a key, opened several deep secrets of nature, in the knowledge whereof he seems to have made a greater progress than all the sects of corpuscularians together

[1] This is to empty the material world of *its* imagined 'forces,' which cannot be distinguished by our senses from the ordered events that are presented to them. It is a refunding of the whole sense-presentable procession into implied Active Reason at its root, as its immanent Cause.

[2] Physician of Louis XV, and professor of chemistry in Paris. He maintained that Fire not only pervades sensible things, as their absolute and ingenerable element, but that it is diffused through their insensible interstices and through space. He made contributions to the Memoirs of the Academy, and, like his father, is distinguished in the annals of French chemistry.

had done before him. Nevertheless, *the principle of attraction itself* is not to be explained by physical or corporeal causes.

246. The Cartesians attempted to explain it by the *nisus* of a subtle element, receding from the centre of its motion, and impelling grosser bodies towards it. Sir Isaac Newton in his later thoughts seems (as was before observed) to have adopted somewhat not altogether foreign from this notion, ascribing that to his elastic medium (sect. 237, 238) which Descartes did to his second element. But the great men of antiquity resolved gravity into the immediate action of an intelligent incorporeal being[1]. To which also Sir Isaac Newton himself attests and subscribes: although he may perhaps sometimes be thought to forget himself, in his manner of speaking of physical agents, which in a strict sense are none at all; and in supposing real forces to exist in bodies, in which, to speak truly, attraction and repulsion should be considered only as tendencies or motions, that is, as mere effects, and their laws as laws of motion.

247. Though it be supposed the chief business of a natural philosopher to trace out causes from the effects, yet this is to be understood not of agents (sect. 155), but of principles; that is, of component parts, in one sense, or of laws or rules, in another. In strict truth, all *agents* are incorporeal; and as such are not properly of physical consideration. The astronomer, therefore, the mechanic, or the chemist, not as such, but by accident only, treat of real causes, agents, or efficients. Neither doth it seem, as is supposed by the greatest of mechanical philosophers, that the true way of proceeding in their science is, from known motions in nature to investigate the moving forces. Forasmuch as force is neither corporeal, nor belongs to any corporeal thing (sect. 220); nor yet to be discovered by experiments or mathematical reasonings, which reach no farther than discernible effects, and motions in things passive and moved.

248. *Vis* or force is to the soul what extension is to the body, saith St. Augustin, in his tract concerning the Quantity of the Soul[2]; and without force there is nothing

[1] Cf. *De Motu*, sect. 32.

[2] *De Quantitate Animæ*, c. 4, &c. The essential passivity of the material world is the constant re-

done or made, and consequently there can be no agent. Authority is not to decide in this case. Let any one consult his own notions and reason, as well as experience, concerning the origin of motion, and the respective natures, properties, and differences of soul and body, and he will, if I mistake not, evidently perceive, that there is nothing active in the latter [1]. Nor are they natural agents or corporeal forces which make the particles of bodies to cohere. Nor is it the business of experimental philosophers to find them out.

249. The mechanical philosopher, as hath been already observed, inquires properly concerning the rules and modes of operation alone, and not concerning the cause; forasmuch as nothing mechanical is or really can be a cause (sect. 236, 247). And although a mechanical or mathematical philosopher may speak of absolute space, absolute motion [2]; and of force as existing in bodies, causing such motion, and proportional thereto [3]; yet what these forces are, which are supposed to be lodged in bodies, to be impressed on bodies, to be multiplied, divided, and communicated from one body to another, and which seem to animate bodies like abstract spirits, or souls, hath been found very difficult, not to say impossible, for thinking men to conceive and explain; as may be seen by consulting Borellus *De Vi Percussionis*, and Torricelli in his *Lezioni Academiche*, among other authors [4].

250. Nor, if we consider the proclivity of mankind to realise their notions [5], will it seem strange that mechanic philosophers and geometricians should, like other men, be misled by prejudice, and take mathematical hypotheses

frain of Berkeley in all his works. It is the foundation of his distinction between ideas (or data of sense) and persons—between things (whose *esse* is *percipi*) and agents—in a word, between myself and Not-myself.

[1] This account of the origin of motion is the leading conclusion in the *De Motu*.

[2] *Absolute* space and motion, i. e. space and motion infinite in quantity, and not necessarily realised in percipient intelligence.

[3] True causation being, with Berkeley, alien to sensible things, and found only in minds, on whose perceptions the concrete reality of sensible things depends.

[4] [This subject is handled at large in my Latin tract *De Motu.*] —AUTHOR.

[5] 'realise their notions,' i. e. by supposing that abstract notions of natural philosophy, such as *force* or *power*, can be pictured in sensuous imagination.

for real beings existing in bodies, so far as even to make it the very aim and end of their science to compute or measure those phantoms; whereas it is very certain that nothing in truth can be measured or computed, besides the very effects or motions themselves. Sir Isaac Newton [1] asks, Have not the minute particles of bodies certain forces or powers by which they act on one another, as well as on the particles of light, for producing most of the phænomena in nature? But, in reality, those minute particles are only agitated according to certain laws of nature, by some other agent, wherein the force exists and not in them, which have only the motion; which motion in the body moved, the Peripatetics rightly judge to be a mere passion; but in the mover to be ἐνέργεια or act.

251. [2] It passeth with many, I know not how, that mechanical principles give a clear solution of the phænomena. The Democritic hypothesis, saith Dr. Cudworth [3], doth much more handsomely and intelligibly solve the phænomena, than that of Aristotle and Plato [4]. But, things rightly considered, perhaps it will be found not to solve any phænomenon at all: for all phænomena [5] are, to speak

[1] *Optics*, Bk. III. Qu. 31.

[2] Sect. 251–264 present, in a condensed form, what, with Berkeley, everywhere in his writings, is the true philosophy of the physical universe; according to which all data of sense, coexisting and successive, are regarded as a *Divine Language*—connected, not as proper causes and effects, but as signs and things signified. His philosophy virtually assumes, without explaining, the legitimacy of our faith in constant natural order.

[3] The passage is as follows:—'The whole Aristotelical system of philosophy is infinitely to be preferred before the whole Democritical; though the former hath been so much disparaged, and the other cried up of late amongst us. Because, though it cannot be denied but that the Democritic hypothesis doth much more handsomely and intelligibly solve the corporeal phænomena, yet in all other things which are of far the greater moment, it is rather a madness than a Philosophy.'—Cudworth's *Intellectual System*, Bk. I. ch. 1. sect. 45. The ancient lore collected in the *Intellectual System* may be compared with that collected in *Siris*. The intense recognition of the *divinity* of natural law, which distinguishes *Siris*, suggests Berkeley's favourite Hooker.

[4] For 'the hypothesis' of Aristotle and Plato, cf. sect. 266, 311–19.

[5] 'Phænomena,' throughout *Siris*, correspond to the 'ideas of sense' in the *Principles*. These are not perceptions, although their concrete reality depends upon their *being perceived*. They are that of which *a* soul or mind must be per-

truly, appearances in the soul or mind[1]; and it hath never been explained, nor can it be explained, how external bodies, figures, and motions, should produce an appearance in the mind. These principles, therefore, do not solve, if by solving is meant assigning the real, either efficient or final, cause of appearances; but only reduce them to general rules.

252. There is a certain analogy, constancy, and uniformity in the phænomena or appearances of nature, which are a foundation for general rules: and these are a grammar for the understanding of nature, or that series of effects in the visible world whereby we are enabled to foresee what will come to pass in the natural course of things[2]. Plotinus observes, in his third Ennead, that the art of presaging is in some sort the reading of natural letters denoting order, and that so far forth as analogy obtains in the universe, there may be vaticination[3]. And in reality, he that foretells the motions of the planets, or the effects of medicines, or the results of chemical or mechanical experiments, may be said to do it by *natural vaticination*[4].

cipient, to make them real, but they do not depend on my mind. *Phænomenon*, with this connotation, is a prominent term in *Siris*, and, for this reason, I have, in the text and in references, retained Berkeley's orthography.

[1] Their realisation, that is to say, involves the percipient experience of a living spirit.

[2] Sight is accordingly foresight, and the sense-symbolism of nature is charged with natural predictions, which physical science interprets when it discovers natural laws.

[3] Lib. III. c. 6. The original of this remarkable passage, which anticipates, and puts on a philosophic basis, the modern conception of *scientific prevision*, is as follows:— *Καὶ γὰρ οὐ τοῦ μάντεως τὸ διότι, ἀλλὰ τὸ ὅτι μόνον εἰπεῖν, καὶ ἡ τέχνη, ἀνάγνωσις φυσικῶν γραμμάτων καὶ τάξιν δηλούντων, καὶ οὐδαμοῦ πρὸς τὸ ἄτακτον ἀποκλινόντων, μᾶλλον δὲ καταμαρτυρούσης τῆς φορᾶς, καὶ εἰς φῶς ἀγούσης καὶ πρὶν παρ' αὐτῶν φανῆναι, οἷος ἕκαστος, καὶ ὅσα. . . . . Ἀναλογίᾳ δὲ σημαίνοντα τὰ ἄλλα τῷ τετηρηκότι, ἐπεὶ καὶ αἱ ἄλλαι μαντικαὶ τῷ ἀναλόγῳ. . . . . Εἰ τοίνυν ἀναλογία ἐν τῷ παντί, καὶ προειπεῖν ἔνι*, &c. This is according to the text of Creuzer. Plotinus treats sense-perceptions as obscure intuitions of that supersensible world of Absolute Reason in which obscurity disappears. Sometimes indeed he seems to divorce the former, as illusory and phantasmic, from true Intellectual Vision.

[4] The modern logic of physical induction is condensed in this and some following sections, which point to the metaphysical presupposition at its foundation.

253. We know a thing when we understand it; and we understand it when we can interpret or tell what it signifies[1]. Strictly, the sense knows nothing[2]. We perceive indeed sounds by hearing, and characters by sight. But we are not therefore said to understand them. After the same manner, the phænomena of nature are alike visible to all: but all have not alike learned the connexion of natural things, or understand what they signify, or know how to vaticinate by them. There is no question, saith Socrates in Theæteto[3], concerning that which *is* agreeable to each person; but concerning what will in time to come be agreeable, of which all men are not equally judges. He who foreknoweth what will be in every kind is the wisest. According to Socrates, you and the cook may judge of a dish on the table equally well; but while the dish is making, the cook can better foretell what will ensue from this or that manner of composing it. Nor is this manner of reasoning confined only to morals or politics, but extends also to natural science.

254. As the natural connexion of *signs* with *the things signified* is regular and constant, it forms a sort of rational discourse (sect. 152), and is therefore the immediate effect of an Intelligent Cause. This is agreeable to the philosophy of Plato, and other ancients. Plotinus[4] indeed saith, that which acts naturally is not intellection, but a certain power of moving matter, which doth not know but only do. And it must be owned that, as faculties are multiplied by philosophers according to their operations, the *will* may be distinguished from the *intellect.* But it will not therefore follow that the Will which operates

[1] To interpret anything *fully* is to shew *all* its relations to every natural thing and person in the universe; which implies Omniscience. Hence all human 'interpretation' of concrete reality is a venture of faith in the goodness of the Universal Power.

[2] 'Sense,' says Cudworth, 'cannot be the knowledge which comprehends a thing as it is. If Sense had [implied] no other power but this of passion or sensation (as Protagoras supposeth), there could then be no such thing as absolute truth or knowledge. But that hypothesis contradicts itself. For that which pronounceth that the sensible ideas of things *are* phantastical and relative, must itself be something superior to Sense, and able to judge what really and absolutely is and is not.' (*Eternal and Immutable Morality.*)

[3] P. 178.

[4] See the *Fourth Ennead*, Bk. IV. c. 13; also *Second Ennead*, Bk. III. c. 17.

in the course of nature is not conducted and applied by intellect, although it be granted that neither will understands, nor intellect wills. Therefore, the phænomena of nature, which strike on the senses and are understood by the mind, do form not only a magnificent spectacle, but also a most coherent, entertaining, and instructive Discourse; and to effect this, they are conducted, adjusted, and ranged by the greatest wisdom. This Language or Discourse is studied with different attention, and interpreted with different degrees of skill. But so far as men have studied and remarked its rules, and can interpret right, so far they may be said to be knowing in nature. A beast is like a man who hears a strange tongue but understands nothing[1].

255. Nature, saith the learned Doctor Cudworth[2], is not master of art or wisdom: nature is *ratio mersa et confusa;* reason immersed and plunged into matter, and as it were fuddled in it and confounded with it. But the formation of plants and animals, the motions of natural bodies, their various properties, appearances, and vicissitudes, in a word, the whole series of things in this visible world, which we call the Course of Nature, is so wisely managed and carried on that the most improved *human* reason cannot thoroughly comprehend even the least particle thereof; so far is it from seeming to be produced by fuddled or confounded reason[3].

256. Natural productions, it is true, are not all equally perfect. But neither doth it suit with the order of things, the structure of the universe, or the ends of Providence, that they should be so. General rules, we have seen (sect. 249, 252), are necessary to make the world intelligible: and from the constant observations of such rules,

[1] This is an application of Berkeley's conception of Visible signs to sensible signs of every kind—existing permanently only in and through Divine Action which they express; but, where imperfectly understood (as by men), in only an imperfect or blurred reality. Bacon's conception of the *interpretability* of Nature so far agrees with this. For Berkeley, compare the sentences introduced in *Alciphron*, Dial. IV. sect. 12, in the third edition.

[2] See *Intellectual System*, Bk. I. ch. 3. § 11, where Cudworth is referring to his 'plastic nature,' and apparently with some expressions of Plotinus in view. Divine, or perfect knowledge, he calls 'unbodied Reason.'

[3] See sect. 253, note 1.

natural evils will sometimes unavoidably ensue: things will be produced in a slow length of time, and arrive at different degrees of perfection.

257. It must be owned we are not conscious of the systole and diastole of the heart, or the motion of the diaphragm. It may not nevertheless be thence inferred, that unknowing nature can act regularly, as well as ourselves. The true inference is—that the self-thinking individual, or human person, is not the real author of those natural motions. And, in fact, no man blames *himself* if they are wrong, or values himself if they are right[1]. The same may be said of the fingers of a musician, which some object to be moved by habit which understands not; it being evident that what is done by rule must proceed from something that understands the rule; therefore, if not from the musician himself, from some other Active Intelligence, the same perhaps which governs bees and spiders, and moves the limbs of those who walk in their sleep[2].

258. Instruments, occasions, and signs (sect. 160) occur in, or rather make up, the whole visible Course of Nature. These, being no agents themselves, are under the direction of One Agent concerting all for one end, the Supreme Good. All those motions, whether in animal bodies, or in other parts of the system of nature, which are not effects of particular wills, seem to spring from the same general cause with the vegetation of plants—an æthereal spirit actuated by a Mind.

259. The first poets and theologers of Greece and the East considered the generation of things as ascribed

[1] His own free voluntary agency is thus, with Berkeley, the measure of the agency for which each person is responsible. Ethical judgment is here (by implication) taken as the *test* for distinguishing *agents* properly so called, from the physical laws according to which the Divine Agent proceeds in nature. Conscience forbids explanation of moral or immoral acts by natural law *only*, and points to the only concrete example of originating and responsible agency.

[2] Cf. sect. 277. So in Cudworth, *Intellectual System*, Bk. I. ch. 3. sect. 12–14. This suggests a vein of speculation in Aristotle's *Physics*; also modern discussions on unconscious mental agency. If our instincts and habits involve a rationality of which we individually are unconscious, this is not evidence that intelligence may be ultimately blind. Rather, it illustrates the omnipresence of Divine Reason in nature.

rather to a Divine cause, but the *physici* to natural causes, subordinate to, and directed still by a Divine; except some corporealists and mechanics, who vainly pretended to make a world without a God. The hidden force that unites, adjusts, and causeth all things to hang together, and move in harmony—which Orpheus and Empedocles styled Love—this principle of union is no blind principle, but acts with intellect. This Divine Love and Intellect are not themselves obvious to our view, or otherwise discerned than in their effects. Intellect enlightens, Love connects, and the Sovereign Good attracts all things[1].

260. All things are made for the Supreme Good, all things tend to that end: and we may be said to account for a thing, when we shew that it is so best. In the Phædon[2], Socrates declares it to be his opinion that he who supposed all things to have been disposed and ordered by a Mind (sect. 154, 160) should not pretend to assign any other cause of them[3]. He blames physiologers for attempting to account for phænomena, particularly for gravity and cohesion, by vortexes and æther; overlooking the τὸ ἀγαθόν and τὸ δέον, the strongest bond and cement which holds together all the parts of the universe[4], and not discerning the cause itself from those things which only attend it.

261. As in the microcosm, the constant regular tenor of the motions of the viscera and contained juices doth not hinder particular voluntary motions to be impressed by the mind on the animal spirit; even so, in the mundane system, the steady observance of certain laws of nature, in

[1] For Orpheus and Empedocles, in sect. 259, see Ritter and Preller, No. 170; Aristotle's *Physics*, VIII. 1.

[2] P. 97. On this philosophy, the office of physical inquiry is not, in any instance, to seek for another ultimate cause than the Divine. It has only to interpret (by referring them to their laws) the sensible signs in which Divine Thought and Power are expressed. Physical causation is simply divinely sustained relation of sensible signs.

[3] Nevertheless a progressive knowledge of *natural causes*, which are to us the signs of coming changes, on which human conduct and happiness depends, is indispensable for man in this embodied life. We are all practically involved in the network of a highly complex sense-symbolism.

[4] The rational ground of our interpretation of the natural and moral universe is—faith in τὸ ἀγαθόν and τὸ δέον.

the grosser masses and more conspicuous motions, doth not hinder but a voluntary agent may sometimes communicate particular impressions to the fine æthereal medium, which in the world answers the animal spirit in man. Which two (if they are two), although invisible and inconceivably small, yet seem the real latent springs whereby all the parts of this visible world are moved[1]; albeit they are not to be regarded as a true cause, but only an instrument, of motion; and the instrument, not as a help to the Creator, but only as a sign to the creature.

262. Plotinus supposeth that the Soul of the universe is not the original cause or author of the species, but receives them from Intellect, the true principle of order and distinction, the source and giver of forms[2]. Others consider the vegetative soul only as some lower faculty of a higher soul which animates the fiery æthereal spirit (sect. 178). As for the blots and defects which appear in the course of this world—which some have thought to proceed from a fatality or necessity in nature, and others from an evil principle—that same philosopher[3] observes, that it may be the Governing Reason produceth and ordaineth all those things; and, not intending that all parts should be equally good, maketh some worse than others by design: as all parts in an animal are not eyes; and in a city, comedy, or picture, all ranks, characters, and colours are not equal or alike; even so excesses, defects, and contrary qualities conspire to the beauty and harmony of the world.

263. It cannot be denied that, with respect to the Universe of things, we in this mortal state are like men educated in Plato's cave, looking on shadows with our backs turned to the light. But though our light be dim,

[1] The co-existence of 'natural law' and 'voluntary agency,' in consistency too with the Divine Rationality of the concrete whole, is one aspect of the perplexity in which the final problem involves a merely human intelligence. How can scientific prevision, which presupposes order, be reconciled with voluntary agency, free to do evil, and thus to create disorder?

[2] 'Soul,' here distinguished from 'Intellect,' is that by which the universe is immediately animated. Ficinus speaks of Intellect as the father, and Matter as the mother of the data of sense.

[3] Plotinus, *Third Ennead*, Lib. IX. c. 1.

and our situation bad, yet if the best use be made of both, perhaps something may be seen[1]. Proclus, in his Commentary on the Theology of Plato, observes there are two sorts of philosophers. The one placed Body first in the order of beings, and made the faculty of thinking depend thereupon, supposing that the principles of all things are corporeal: that Body most really or principally exists, and all other things in a secondary sense, and by virtue of that. Others, making all corporeal things to be dependent upon Soul or Mind, think this to exist in the first place and primary sense, and the being of Bodies to be altogether derived from, and presuppose that of the Mind[2].

264. Sense and experience acquaint us with the course and analogy of appearances or natural effects. Thought, reason, intellect introduce us into the knowledge of their causes. Sensible appearances, though of a flowing, unstable, and uncertain nature, yet having first occupied the mind, they do by an early prevention render the aftertask of thought more difficult; and, as they amuse the eyes and ears, and are more suited to vulgar uses and the mechanic arts of life, they easily obtain a preference, in the opinion of most men, to those superior principles, which are the later growth of the human mind arrived to maturity and perfection; but, not affecting the corporeal sense, are thought to be so far deficient in point of solidity and reality, *sensible* and *real*, to common apprehensions, being the same thing[2]. Although it be certain that the *principles* of science are neither objects of sense nor imagination; and that intellect and reason are alone the sure guides to truth[3].

[1] Compare this modest estimate of the intellectual faculty of man with the sanguine view suggested in the *Principles*.—Introduction, sect. 1–3.

[2] *In Platonis Theologiam*, Lib. I. c. 3. Human thought still oscillates between these extremes. Proclus lived in the fifth century, A. D.

[3] Cf. *Principles*, sect. 36, 89. In *Siris*, animated by the Platonic spirit, he rises to a reflexive recognition of reality as forms in the 'principles of science'—the universal relations of Intellect—which are apprehended in Sense, presentative and representative, at the best, only in a dim and confused way. This section is a characteristic expression of Berkeley's later philosophy, influenced by Plato and Plotinus. In the *Principles*, he vindicates the mind-dependent reality of sensible things, which he now seems to disparage.

265. The successful curiosity of the present age, in arts, and experiments, and new systems, is apt to elate men, and make them overlook the Ancients. But, notwithstanding that the encouragement and purse of princes, and the united endeavours of great Societies in these later ages, have extended experimental and mechanical knowledge very far, yet it must be owned that the ancients too were not ignorant of many things (sect. 166, 167, 168, 241, 242, &c.), as well in physics as metaphysics, which perhaps are more generally, though not first, known in these modern times[1].

266. The Pythagoreans and Platonists had a notion of the true system of the world[2]. They allowed of mechanical principles, but actuated by soul or mind: they distinguished the primary qualities in bodies from the secondary, making the former to be physical causes[3]; and they understood

[1] In what follows (sect. 266–368) Berkeley vindicates, by the authority of Ancient Philosophers, Greek and Oriental, his conception of the concrete universe, as constantly dependent on, and ultimately explicable, substantially and causally, only in living Mind. He thus ascends from sense and sensuous imagination to the 'principles of Science,' those uncreated necessities of Intellect, through which the data of sense are intelligibly connected.

Not to speak of preceding historical inquirers, Hegel, Erdmann, Ueberweg, and Zeller have modified and extended the conception of Greek opinions and their concatenation, attainable by Berkeley.

[2] Sect. 100, 232, 251–254. The spirit of *Siris* is reflected in the pregnant summary of Greek philosophy given in sect. 266, 267.

[3] In the *First Dialogue between Hylas and Philonous* this distinction of qualities is referred to as unavailable in defence of abstract Matter. Both sorts, it is argued, are relative and mutable. Here the Pythagoreans and Platonists are praised for regarding the primary qualities as physical causes, or sensible signs, of the secondary. This is done perhaps on the principle that *visible and tangible extensions, and their relations* (because permanent, impersonal, and universally characteristic of sensible things), are more appropriately regarded as *signs* of transient tastes, smells, and sounds, than these last of the former. So-called secondary qualities (qualities proper) are thus referred, as (physical) effects, to the modes of sensible extent (primary qualities) with which they are severally connected by natural law; but not *vice versa*. The atomic theory of the material world, in part adopted by Locke, so far accords with this. With Plato, extension and its geometrical implicates are, it seems, the qualities exclusively regarded as irrelative or primary—true for all minds; all the others, including solidity, are relative to the conditions of sense in man. See *Timæus*, pp. 61–64.

physical causes in a right sense[1]: they saw that a Mind infinite in power, unextended, invisible, immortal, governed, connected, and contained all things[2]: they saw there was no such thing as real absolute space[3]: that mind, soul, or spirit truly and really exists[4]: that bodies exist only in a secondary and dependent sense[5]: that the soul is the place of forms: that the sensible qualities are to be regarded as acts only in the cause, and as passions in us[6]: they accurately considered the differences of intellect, rational soul, and sensitive soul, with their distinct acts of intellection, reasoning, and sensation[7], points wherein the Cartesians and their followers, who consider sensation as a mode of thinking, seem to have failed. They knew there was a subtle æther[8] pervading the whole mass of corporeal beings, and which was itself actually moved and directed by a mind: and that physical causes were only instruments, or rather marks and signs[9].

267. Those ancient philosophers understood the generation of animals to consist in the unfolding and distending of the minute imperceptible parts of pre-existing animalcules[10], which passeth for a modern discovery; this they took for the work of nature, but nature animate and intelligent (sect. 172): they understood that all things were alive and in motion[11]: they supposed a concord and discord, a union and disunion, in particles, some attracting, others repelling each other; and that those attractions and repulsions, so various, regular, and useful, could not be accounted for, but by an Intelligence presiding and directing all particular motions, for the conservation and benefit of the Whole[12].

268. The Egyptians, who impersonated nature, had made her a distinct principle, and even deified her under

[1] Cf. sect. 279, 288, 300, 320, 322–329.
[2] Cf. sect. 270, 271, 289, 242, 293, 304, 318.
[3] Cf. sect. 290–295.
[4] Cf. sect. 306, 311–318.
[5] Cf. sect. 269, 310, 328.
[6] Cf. sect. 289, 304.
[7] Sect. 275, 302–304.
[8] Cf. sect. 152, 166, 171, 177, 211, 277.
[9] Cf. sect. 155, 160, 231, 235, 247–249, 251–254.
[10] Cf. sect. 282.
[11] Cf. sect. 153, 276.
[12] Cf. sect. 162, 164, 165, 234, 237, 251, 271, 272.

265. The successful curiosity of the arts, and experiments, and new system men, and make them overlook the An withstanding that the encouragement and and the united endeavours of great Soc ages, have extended experimental and ledge very far, yet it must be owned were not ignorant of many things (sec 242, &c.), as well in physics as metaph are more generally, though not modern times[1].

266. The Pythagoreans and Pla the true system of the world[2]. The principles, but actuated by soul or the primary qualities in bodies from the former to be physical cate

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[2] Sect. 100, 292, spirit of *Siris* pregnant summary sophy given in

[3] In the *Fir Hylas and Ph* tion of qualities unavailable in Matter. Both

many of their other opinions were

trine of real, absolute, external Space[1] odern philosophers[2] to conclude it was ute of God, or that God himself was as incommunicable attributes of the to agree thereto, such as infinity, im- visibility, incorporeity, being uncreated, out beginning or ending; not considering negative properties may belong to nothing. nath no limits, cannot be moved, or changed, neither created nor destroyed. A different ng appears in the Hermaic as well as other the ancients. With regard to absolute space, d in the Asclepian Dialogue[3], that the word ce hath by itself no meaning; and again, that sible to understand what space alone or pure nd Plotinus acknowledgeth no place but soul xpressly affirming that the soul is not in the

[1] 270-284 contrast the mption of absolute well as blind Necessity ith the ancient and more doctrine of *anima mundi*; material but unconscious , with Plato intermediate the archetypal Ideas and and with others the vital force of the uni-

Samuel Clarke. With eley *this* Space is an empty ion. Sensible extension only actual space he re- ises. Insensible Space, like ensible Matter, is for him a eaningless abstraction, 'a thing erely visionary' (sect. 271). Cf. *New Theory of Vision*, sect. 122-26; *Principles of Human Knowledge*, sect. 116, 117; *De Motu*, sect. 52-57, 63. The Space against Berkeley argues is that of **ancient and many** modern **philosophers** and mathematicians—a huge, infinitely extended, self-subsistent entity, supposed to condition all existence; so that everything in the universe must be extended, and spiritual or unextended beings are impossible, every thing consisting of *partes extra partes* necessarily 'external' to each other. According to the *Principles*, Space is sensible extension—created, not infinitely divisible, of which the original elements are contributed in touch and sight, founded upon established associations between what we see and what we touch. But according to *Siris* Space is 'neither a datum of sense, nor our intellectual notion,' and so is regarded otherwise than in the *Principles*.

[3] Asclepius, a reputed disciple of Hermes. The work referred to is the famous dialogue between Hermes and Asclepius, *De Natura Deorum*.

world, but the world in the soul. And farther, the place of the soul, saith he, is not body, but soul is in mind, and body in the soul. See the third chapter of the fifth book of the fifth Ennead.

271. Concerning absolute space, that phantom of the mechanic and geometrical philosophers (sect. 250), it may suffice to observe that it is neither perceived by any sense, nor proved by any reason, and was accordingly treated by the greatest of the ancients as a thing merely visionary. From the notion of absolute space springs that of absolute motion[1]; and in these are ultimately founded the notions of external existence, independence, necessity, and fate. Which Fate, the idol of many moderns, was by old philosophers differently understood, and in such a sense as not to destroy the αὐτεξούσιον of God or man. Parmenides, who thought all things to be made by necessity or fate, understood justice and Providence to be the same with fate; which, how fixed and cogent soever with respect to man, may yet be voluntary with respect to God. Empedocles declared fate to be a cause using principles and elements. Heraclitus taught that fate was the general reason that runs through the whole nature of the universe; which nature he supposed to be an æthereal body, the seed of the generation of all things. Plato held fate to be the eternal reason or law of nature. Chrysippus supposed that fate was a spiritual power which disposed the world in order; that it was the reason and law of those things which are administered by Providence[2].

272. All the foregoing notions of fate, as represented by Plutarch, do plainly shew that those ancient philosophers did not mean by fate, a blind, headlong, unintelligent

[1] [Our judgment in these matters is not to be overborne by a presumed evidence of mathematical notions and reasonings, since it is plain the mathematicians of this age embrace obscure notions, and uncertain opinions, and are puzzled about them, contradicting each other and disputing like other men: witness their doctrine of Fluxions, about which, within these ten years, I have seen published about twenty tracts and dissertations, whose authors being utterly at variance, and inconsistent with each other, instruct bystanders what to think of their pretensions to evidence.]—AUTHOR.

Berkeley of course refers in this note to the *Analyst* controversy, and repeats former conclusions.

[2] See Ps.-Plutarch, *De Placit. Philos.* Lib. I. cap. 25–28, for the opinions of those philosophers on Fate. Berkeley seems to have those chapters in his eye here.

principle, but an orderly settled course of things, conducted by a wise and provident Mind. And as for the Egyptian doctrine, it is indeed asserted in the Pimander, that all things are produced by fate[1]. But Jamblichus, who drew his notions from Egypt, affirms that the whole of things is not bound up in fate; but that there is a principle of the soul higher than nature, whereby we may be raised to a union with the gods, and exempt ourselves from fate[2]. And in the Asclepian Dialogue[3] it is expressly said that fate follows the decrees of God. And indeed, as all the motions in nature are evidently the product of reason (sect. 154), it should seem there is no room for necessity—in any other sense than that of a steady regular course.

273. Blind fate and blind chance are at bottom much the same thing, and one no more intelligible than the other. Such is the mutual relation, connexion, motion, and sympathy of the parts of this world, that they seem as it were animated and held together by one Soul: and such is their harmony, order, and regular course, as sheweth the soul to be governed and directed by a Mind. It was an opinion of remote antiquity that the World was an Animal (sect. 153, 172). If we may trust the Hermaic writings, the Egyptians thought all things did partake of life. This opinion was also so general and current among the Greeks that Plutarch[4] asserts all others held the world to be an Animal, and governed by Providence; except Leucippus, Democritus, and Epicurus. And although an Animal containing all bodies within itself could not be touched or sensibly affected from without[5], yet it is plain they attributed to it an inward sense and feeling, as well as appetites and aversions; and that from all the various

[1] The dialogue called *Pœmander*, which treats of nature in its ultimate relations to Divine Power and Wisdom, is the most memorable of the Hermic works. It is probably Neo-platonic, and of the fourth century after Christ, though long ascribed to the Egyptian Hermes. In the *Pœmander* the individuality of man seems lost in the Supreme Power.

[2] i. e. the spiritual principle in the human soul, in possession of which man is in the image of God. We have fragments of Jamblicus, *De Fato*, recovered from the Palatine MSS. (ed. 1668), and Ficinus, *De Mysteriis* (De Fato); also Proclus on Providence and Fate.

[3] Cap. 14, *De Fatis*.

[4] *De Placit. Philos.* Lib. II. c. 3.

[5] As it were extra-organically.

tones, actions, and passions of the universe, they suppose one symphony, one animal act and life to result.

274. Jamblichus[1] declares the world to be one Animal, in which the parts, however distant each from other, are nevertheless related and connected by one common nature. And he teacheth, what is also a received notion of the Pythagoreans and Platonics, that there is no chasm in nature[2], but a Chain or Scale of beings, rising by gentle uninterrupted gradations from the lowest to the highest, each nature being informed and perfected by the participation of a higher[3]. As air becomes igneous, so the purest fire becomes animal, and the animal soul becomes intellectual: which is to be understood not of the change of one nature into another, but of the connexion of different natures; each lower nature being, according to those philosophers, as it were a receptacle or subject for the next above it to reside and act in.

275. It is also the doctrine of Platonic philosophers, that Intellect is the very life of living things, the first principle and exemplar of all, from whence by different degrees are derived the inferior classes of life: first the rational[4], then the sensitive, after that the vegetal; but so as in the rational animal there is still somewhat intellectual, again in the sensitive there is somewhat rational, and in the vegetal somewhat sensitive, and lastly, in mixed bodies, as metals and minerals, somewhat of vegetation. By which means the whole is thought to be more perfectly connected. Which doctrine implies that all the faculties, instincts, and motions of inferior beings, in their

[1] *De Mysteriis*—Opinio Egyptiorum de Deo. See the relative Commentary of Ficinus.

[2] 'no chasm in nature,' i. e. natural order is continuous.

[3] The notion of a Chain (σειρά, dim. σειρίς, whence *Siris*) in nature, connecting the phenomena and events of the universe with one another, and with God, in a Cosmos or orderly system in which each phenomenon is rationally linked with every other, was not foreign to the ancient world. So Milton, *Par. Lost*, V. 469-490.

[4] i. e. *discursive reason*, as distinguished from *intuitive reason*, or Intellect proper.—The ancient notion of a graduated organic unity in the universe, referred to in this section—traversed by the Cartesian antithesis of thought and extension—conscious human agents and mechanically moved brutes—reappears in speculation of last, and still more of this century, e. g. Fichte's *Die Bestimmung des Menschen*, and in the favourite modern conception of evolution or development.

several respective subordinations, are derived from, and depend upon Mind and Intellect.

276. Both Stoics and Platonics held the world to be alive; though sometimes it be mentioned as a sentient animal, sometimes as a plant or vegetable[1]. But in this, notwithstanding what hath been surmised by some learned men, there seems to be no Atheism. For, so long as the world is supposed to be quickened by elementary fire or spirit, which is itself animated by soul, and directed by understanding, it follows that all parts thereof originally depend upon, and may be reduced unto the same indivisible stem or principle, to wit, a Supreme Mind; which is the concurrent doctrine of Pythagoreans, Platonics, and Stoics[2].

277. There is, according to those philosophers, a life infused throughout all things: the πῦρ νοερόν, πῦρ τεχνικόν, an intellectual and artificial fire (sect. 166, 168, 174, 175, &c.)—an inward principle, animal spirit, or natural life, producing and forming within as art doth without; regulating, moderating, and reconciling the various motions, qualities, and parts of this mundane system. By virtue of this life the great masses are held together in their orderly courses, as well as the minutest particles governed in their natural motions, according to the several laws of attraction, gravity, electricity, magnetism, and the rest. It is this gives instincts, teaches the spider her web, and the bee her honey. This it is that directs the roots of plants to draw forth juices from the earth, and the leaves and corticle vessels to separate and attract such particles of air, and elementary fire, as suit their respective natures[3].

278. Nature seems to be not otherwise distinguished from the *anima mundi* than as life is from soul[4], and, upon

[1] Cf. sect. 153. See Ps.-Plutarch, *De Placit. Philos.* Lib. I. c. 3; Diogenes Laert. Lib. VII.

[2] Faith in the absolute supremacy of Omnipotent Intelligence, is here recognised, under various forms of expression, as latent in the gradual evolution of vegetable into animal life, and of animal into rational and moral life. Evolution is a physically scientific, not an ultimate or philosophic conception; although moral and religious conceptions, and intellectually necessary truths may be developed in human consciousness under this law, as a condition of their development, the *results* evolved are unaccountable by this or any other natural law.

[3] Cf. sect. 257.

[4] 'Soul,' i.e. *animating principle*, as distinguished from its effects or manifestations that are presented

the principles of the oldest philosophers, may not improperly or incongruously be styled the life of the world. Some Platonics, indeed, regard life as the act of nature, in like manner as intellection is of the mind or intellect. As the First Intellect acts by understanding, so nature according to them acts or generates by living. But life is the act of the soul, and seems to be very nature itself, which is not the principle, but the result of another and higher principle, being a life resulting from soul, as cogitation from intellect.

279. If nature be [[1] supposed] the life of the world, animated by one soul, compacted into one frame, and directed or governed in all parts by one mind: this system cannot be accused of Atheism; though perhaps it may of mistake or impropriety. And yet, as one presiding Mind gives unity to the infinite aggregate of things, by a mutual communion of actions and passions, and an adjustment of parts, causing all to concur in one view to one and the same end—the ultimate and supreme good of the whole; it should seem reasonable to say, with Ocellus Lucanus[2] the Pythagorean, that as life holds together the bodies of animals, the cause whereof is the soul; and as a city is held together by concord, the cause whereof is law, even so the world is held together by harmony, the cause whereof is God. And in this sense the world or Universe may be considered either as one Animal or one city (sect. 172, 277).

280. Aristotle[3] disapproves the opinion of those who hold a soul to be diffused throughout the world; and for this reason, because the elements are not alive. Though

to our senses—all nature being, by the supposition, animated. Soul (ψυχή) was distinguished from body, on the one hand, and from reason (νοῦς), on the other—mediating between them. The ancient notion of the animation of the Universe appears, in one form or another, among the physical philosophers of the sixteenth and seventeenth centuries, for instance, Telesius and Campanella.

[1] Not in the early editions.

[2] Ocelli Lucani *De Legibus* (Fragmentum ex Stobæo Egl. Phys. Lib. I. cap. 16)—now rejected as spurious, with the other fragments attributed to Ocellus Lucanus. His teaching is apt to be identified with Hylozoism, or the conception of the universe as living Matter. Conscious life in man is then a transitory manifestation of the Matter, under certain conditions—all inconsistent with a fundamentally ethical or theistic conception of the Power for ever and finally at work.

[3] Cf. sect. 230.

perhaps it may not be easy to prove that blood and animal spirit are more alive in man, than water and fire in the world. That philosopher, in his books of the Soul[1], remarks upon an opinion set forth in the Orphics, of the soul's entering from the universe into living creatures being borne by winds—that this cannot be true of plants, or of certain animals which do not breathe. But air vessels are by later experiments allowed to be found in all plants and animals[2]. And air may in some sort not improperly be said to be the carrier or vehicle of the soul, inasmuch as it is the vehicle of fire, which is the spirit immediately moved and animated by the soul (sect. 163, 171).

281. The living fire, the living, omniform seminary of the world, and other expressions of the like nature, occurring in the Ancient and Platonic philosophy[3], how can they be understood exclusive of light or elemental fire, the particles of which are known to be heterogeneous, and, for aught we know, may some of them be organised, and, notwithstanding their wonderful minuteness, contain original seeds which, being formed and sown in a proper matrix, do gradually unfold and manifest themselves, still growing to a just proportion of the species.

282. May not this æthereal seminary, consistently with the notions of that philosophy which ascribed much of generation to celestial influence, be supposed to impregnate plants and animals with the first principles, the stamina, or those animalcules which Plato, in his *Timæus*[4], saith are invisible for their smallness, but, being sown in a proper matrix, are therein gradually distended and explicated by nourishment, and at length the animals brought forth to light? Which notion hath been revived and received of late years by many, who perhaps are not aware of its antiquity, or that it was to be found in Plato. Timæus Locrensis, in his book of the Soul of the World[5], supposeth even souls to be derived from the celestial luminaries, excepting only the rational or intellectual part.

[1] *De Anima*, Lib. I. c. 5.

[2] Cf. sect. 29.

[3] So also in Ficinus, in many passages.

[4] P. 91. This Platonic notion was revived by Leuwenhoeck (1632–1723), the Dutch naturalist. Cf. sect. 267, 283.

[5] Timæi Locri *De Anima Mundi*, cap. 4—now regarded as spurious

But what influence or influx is there from the celestial bodies which hath not light for its vehicle? (sect. 43).

283. What other nature there should be intermediate between the soul of the world (sect. 171) and this gross corporeal system, which might be the vehicle of life, or, to use the language of philosophers, might receive or be impressed with the forms of things, is difficult to comprehend. It is a vulgar remark, that the works of art do not bear a nice microscopical inspection, but the more helps are used, and the more nicely you pry into natural productions, the more do you discover of the fine mechanism of nature, which is endless or inexhaustible; new and other parts, more subtle and delicate than the precedent, still continuing to offer themselves to view. And these microscopical observations have confirmed the ancient theory concerning generation, delivered in the *Timæus* of Plato. But that theory or hypothesis, how agreeable soever to modern discoveries, is not alone sufficient to explain the phænomena, without the immediate action of a mind. And Ficinus, notwithstanding what himself and other Platonics say of a plastic nature, is obliged to own that with the mundane force or soul it is to be understood there is joined an intelligence, upon which the seminal nature constantly depends, and by which it is governed.

284. Alcinous, in his tract of the Doctrine of Plato[1], saith that God hath given the world both mind and soul: others include both in the word soul, and suppose the soul of the world to be God. Philo[2] appears to be of this opinion in several parts of his writings. And Virgil[3], who was no stranger to the Pythagorean and Platonic tenets, writes to the same purpose:

> Deum namque ire per omnes
> Terrasque, tractusque maris, cœlumque profundum.
> Hinc pecudes, armenta, viros, genus omne ferarum,
> Quemque sibi tenues nascentem arcessere vitas.

[1] The *De Doctrina Platonis* of Alcinous, cap. 14, an exposition of Platonism, at one time in high repute.

[2] The syncretism of Philo, the Jewish philosopher (a contemporary of Christ), is so little constructed upon consistent principle, that it is difficult to determine whether this opinion should be attributed to him. With the Stoics, he seems to ascribe the central activity in all change to Deity, and mere passivity to matter, in analogy with the suggestion of the text. On the other hand, the mysterious ineffability of Deity, and antithesis between God and the universe, are suggested by his writings.

[3] *Georg.* IV. 221–24.

Thus much the schools of Plato and Pythagoras seem agreed in, to wit, that the Soul of the World (sect. 153, 172), whether having a distinct mind of its own, or directed by a superior mind (sect. 154, 279), doth embrace all its parts, connect them by an invisible and indissoluble Chain, and preserve them ever well adjusted and in good order.

285. Naturalists[1], whose proper province it is to consider phænomena, experiments, mechanical organs and motions, principally regard the visible frame of things or corporeal world; supposing soul to be contained in body. And this hypothesis may be tolerated in physics, as it is not necessary in the arts of dialling or navigation to mention the true system or earth's motion. But those who, not content with sensible appearances, would penetrate into the real and true causes (the object of theology, metaphysics, or the *philosophia prima*[2]), will rectify this error, and speak of the world as contained by the soul, and not the soul by the world.

286. Aristotle hath observed there were indeed some who thought so grossly as to suppose the universe to be one only corporeal and extended nature: but in the first book of his *Metaphysics*[3] he justly remarks they were guilty of a great mistake; forasmuch as they took into their account the elements of corporeal beings alone, whereas there are incorporeal beings also in the universe; and while they attempted to assign the causes of generation and corruption, and account for the nature of all things, they did at the same time destroy the very cause of motion.

287. It is a doctrine among other speculations contained in the Hermaic writings—that all things are One. And it is not improbable that Orpheus, Parmenides, and others

[1] In sect. 285-296 the ultimate dependence of sensible things and space on all-containing and all-regulating Mind, 'the source of unity and identity, harmony and order, existence and stability' (sect. 295)—of which the doctrine of *anima mundi* is an imperfect adumbration—is further unfolded. *Anima mundi* involves the vitality of the universe, and would resolve physical cosmology into an expanded biology. See Pseudo-Plutarch, Lib. II. c. 35; also Bessarion, and Cudworth.

[2] Cf. sect. 263. With Aristotle these are one. See *Metaph.* Lib. VI. c. 1 and Lib. XI. c. 7.

[3] *Metaph.* Lib. I. c. 3.

among the Greeks, might have derived their notion of Τὸ Ἕν, THE ONE, from Egypt. Though that subtle metaphysician Parmenides, in his doctrine of ἓν ἕστως, seems to have added something of his own. If we suppose that one and the same Mind is the Universal Principle of order and harmony throughout the world, containing and connecting all its parts, and giving unity to the system, there seems to be nothing atheistical or impious in this supposition [1].

288. Number is no object of sense: it is an act of the mind. The same thing in a different conception is one or many [2]. Comprehending God and the creatures in one general notion, we may say that all things together make one universe, or τὸ πᾶν. But if we should say that all things make one God, this would, indeed, be an erroneous notion of God; but would not amount to Atheism, so long as Mind or Intellect was admitted to be the τὸ ἡγεμονικόν, the governing part [3]. It is, nevertheless, more respectful, and consequently the truer notion of God, to suppose him neither made up of parts, nor to be himself a part of any whole whatsoever.

289. All those who conceived the Universe to be an Animal must, in consequence of that notion, suppose all things to be One. But to conceive God to be the sentient soul of an animal is altogether unworthy and absurd. There is no sense nor sensory, nor any thing like a sense or sensory, in God. Sense implies an impression from some other being, and denotes a dependence in the soul which hath it. Sense is a passion: and passions imply imperfection. God knoweth all things, as pure mind or intellect; but nothing by sense, nor in nor through a sensory. Therefore to suppose a sensory of any kind—whether space [4] or any other—in God, would be very wrong, and lead us into false conceptions of His nature [5].

[1] Here and elsewhere in *Siris*, he is in sympathy with the conception of the immanence of Deity in nature, favoured by the Neoplatonists, and by the Alexandrian theologians with whom he became familiar in his later years.

[2] Cf. *Principles*, sect. 12, 13, 119–122.

[3] It is a theism, when so expressed, that is difficult to reconcile with free moral agency in the universe, unless we distinguish moral agents from 'things.'

[4] As Newton suggests.

[5] He accordingly rejects the supposition that the things of sense are perceived *sensibly* in the Divine

The presuming there was such a thing as real, absolute, uncreated space seems to have occasioned that modern mistake. But this presumption was without grounds [1].

290. Body is opposite to spirit or mind. We have a notion of spirit from thought and action. We have a notion of body from resistance [2]. So far forth as there is real power, there is spirit. So far forth as there is resistance, there is inability or want of power: that is, there is a negation of spirit. We are embodied, that is, we are clogged by weight, and hindered by resistance. But in respect of a perfect spirit, there is nothing hard or impenetrable: there is no resistance to the Deity: nor hath he any body: nor is the Supreme Being united to the world as the soul of an animal is to its body; which necessarily implieth defect, both as an instrument, and as a constant weight and impediment [3].

291. Thus much it consists with piety to say—that a Divine Agent doth by his virtue permeate and govern the elementary fire or light (sect. 157, 172), which serves as animal spirit to enliven and actuate the whole mass, and all the members of this visible world [4]. Nor is this doctrine

Intelligence, holding that in God they are realised in 'a wholly intellectual way,' whatever that means. The passivity characteristic of sense implies a reality that is independent of each individual percipient. It is thus that the events of sense, by their independence of my personal agency, awaken in me the sense of my own individual personality, rounded off by omnipresent Power other than my own.

[1] Cf. sect. 270, 271, 378, where Berkeley gives reasons for rejecting 'real, absolute, uncreated space.'

[2] Berkeley notes (passive) *resistance* and *solidity*, not *extension*, as the characteristic of body. So too in his early philosophical works. But how, under his conception of the reality of matter, are tangible realisations *more* real than visual or audible?

[3] He thus sees that the analogy between the relation of the soul of man to his body, and that of God to the universe, must be imperfect, in respect of the Divine omniscience and omnipotence; also in respect of the sentient beings and moral agents included in the universe, to which nothing corresponds in the human body.

[4] We have here a hint of the origin of Berkeley's inclination to the 'fire philosophy.' He seemed to, by this means, escape the need for conceiving God to be the *sentient* soul of the animal Universe. It is one of the many attempts to *unify* physics under one supreme dynamic law, immediately subordinate to God—thus harmonising our ultimate conception in physics with religious faith. The *anima mundi* of Plato, the *archæus* of Paracelsus, and the 'plastic nature' of Cudworth, may perhaps be

less philosophical than pious. We see all nature alive or in motion. We see water turned into air, and air rarefied and made elastic (sect. 149, 152, 200) by the attraction of another medium, more pure indeed, more subtle, and more volatile, than air. But still, as this is a moveable, extended, and consequently a corporeal being (sect. 207), it cannot be itself the principle of motion, but leads us naturally and necessarily to an incorporeal spirit or agent. We are conscious that a spirit can begin, alter, or determine motion; but nothing of this appears in body. Nay, the contrary is evident, both to experiment and reflexion.

292. Natural phænomena are only natural appearances. They are, therefore, such as we see and perceive them [1]. Their real and objective [2] natures are, therefore, the same: passive without anything active; fluent and changing without anything permanent in them. However, as these make the first impressions, and the mind takes her first flight and spring, as it were, by resting her foot on these objects, they are not only first considered by all men, but most considered by most men. They and the phantoms that result from those appearances—the children of imagination grafted upon sense—such for example as pure space (sect. 270), are thought by many the very first in existence and stability, and to embrace and comprehend all other beings.

293. Now, although such phantoms as *corporeal forces*, *absolute motions*, and *real spaces* do pass in physics for causes and principles (sect. 220, 249, 250), yet are they in truth but hypotheses; nor can they be the objects of real science [3]. They pass nevertheless in physics, conversant about things of Sense, and confined to experiments and mechanics. But when we enter the province of the *philosophia prima*, we discover another order of beings—Mind and its acts; permanent being; not dependent on corporeal things; nor resulting, nor connected, nor contained, but containing, connecting, enlivening the whole

similarly explained. Note what is said of 'sense' in sect. 259.

[1] They are in short only data of sense, to which we must attribute nothing that is not actually presented to the senses. This is the refrain also throughout the *De Motu*.

[2] 'objective' here means apparent or phenomenal.

[3] Cf. *De Motu*, which criticises those favourite abstractions of natural philosophers, and their working hypotheses.

frame; and imparting those motions, forms, qualities, and that order and symmetry, to all those transient phænomena, which we term the Course of Nature.

294. It is with our faculties as with our affections: what first seizes holds fast (sect. 264). It is a vulgar theme, that man is a compound of contrarieties, which breed a restless struggle in his nature, between flesh and spirit, the beast and the angel, earth and heaven, ever weighed down and ever bearing up[1]. During which conflict the character fluctuates: when either side prevails, it is then fixed for vice or virtue. And life from different principles takes a different issue. It is the same in regard to our faculties. Sense at first besets and overbears the mind. The sensible appearances are all in all: our reasonings are employed about them: our desires terminate in them: we look no farther for realities or causes; till Intellect begins to dawn, and cast a ray on this shadowy scene. We then perceive the true principle of unity, identity, and existence[2]. Those things that before seemed to constitute the whole of Being, upon taking an intellectual view of things, prove to be but fleeting phantoms.

295. From the outward form of gross masses which occupy the vulgar, a curious inquirer proceeds to examine the inward structure and minute parts, and, from observing the motions in nature, to discover the laws of those motions. By the way he frames his hypothesis, and suits his language to this natural philosophy. And these fit the occasion and answer the end of a maker of experiments or mechanic; who means only to apply the powers of nature, and reduce the phænomena to rules. But if, proceeding still in his analysis and inquiry, he ascends from the sensible into the intellectual world[3], and beholds things in a new light and a new order, he will then change his system, and perceive that what he took for substances and causes are but fleeting shadows: that the Mind contains all, and acts all, and is to all created beings the source of unity and identity, harmony and order, existence and stability[4].

[1] So Pascal in the *Pensées*.

[2] Namely, Spirit or Mind.

[3] Rising from science that is only physical to metaphysical philosophy.

[4] Compare this and what follows with Berkeley's juvenile jets of thought in his *Commonplace Book*, in which 'mind' seems almost to resolve into empirical data of

296. It is neither acid, nor salt, nor sulphur, nor air, nor æther, nor visible corporeal fire (sect. 155), much less the phantom Fate or Necessity, that is the real agent, but, by a certain analysis, a regular connexion and climax, we ascend through all those mediums to a glimpse of the First Mover, invisible, incorporeal, unextended, intellectual source of life and being. There is, it must be owned, a mixture of obscurity and prejudice in human speech and reasonings. This is unavoidable, since the veils of prejudice and error are slowly and singly taken off one by one. But, if there are many links in the Chain which connects the two extremes of what is grossly sensible and purely intelligible, and it seems a tedious work, by the slow helps of memory, imagination, and reason[1], oppressed and overwhelmed, as we are, by the senses, through erroneous principles, and long ambages of words and notions, to struggle upwards into the light of truth; yet, as this gradually dawns, farther discoveries still correct the style and clear up the notions.

297. The Mind her acts and faculties, furnish a new and distinct class of objects (sect. 163, 266), from the contemplation whereof arise certain other notions, principles, and verities, so remote from, and even so repugnant to, the first prejudices which surprise the sense of mankind that they may well be excluded from vulgar speech and books, as *abstract* from sensible matters, and more fit for the speculation of truth, the labour and aim of a few, than for the practice of the world, or the subjects of experimental or mechanical inquiry[2]. Nevertheless, though, perhaps, it may not be relished by some modern readers, yet the treating in physical books concerning metaphysical and divine matters can be justified by great authorities among the ancients: not to mention that he who professedly delivers the elements of a science is more obliged to method and system, and tied down to more rigorous

sense, and abstract intellectual necessities to be disparaged. 'Pure intellect I understand not. We must with the mob place certainty in the senses. Mind is a congeries of perceptions. Take away perceptions and you take away the mind. Put the perceptions and you put the mind. Sensual pleasure is the *summum bonum*.'

[1] 'reason' = discursive thought or reasoning, not intuitive reason.

[2] Former hostility to 'abstractions' seems abated here.

laws, than a mere essay writer. It may, therefore, be pardoned if this rude Essay doth, by insensible transitions, draw the reader into remote inquiries and speculations, that were not, [[1] perhaps,] thought of either by him or by the author at first setting out.

298. There are traces of profound thought as well as primeval tradition in the Platonic, Pythagorean, Egyptian, and Chaldaic philosophy (sect. 179, 266). Men in those early days were not overlaid with languages and literature. Their minds seem to have been more exercised, and less burdened, than in later ages; and, as so much nearer the beginning of the world, to have had the advantage of patriarchal lights handed down through a few hands[2]. It cannot be affirmed indeed (how probable soever it may seem) that Moses was that same Mochus, with whose successors, priests and prophets, Pythagoras is said to have conversed at Sidon. Yet the study of philosophy appears to be of very great antiquity and remote original; inasmuch as Timæus Locrensis, that ancient Pythagorean, author of the book concerning the Soul of the World[3], speaks of a most ancient philosophy, even in his time, ἁ πρεσβύστα φιλοσοφία, stirring up and recovering the soul from a state of ignorance to the contemplation of Divine things. And though the books attributed to Mercurius Trismegistus were none of them wrote by him, and are allowed to contain some manifest forgeries, yet it is also allowed that they contain tenets of the ancient Egyptian philosophy, though dressed, perhaps, in a more modern garb. To account for which, Jamblichus observes that the books under his name contain indeed mercurial opinions, though often expressed in the style of the Greek philosophers; as having been translated from the Egyptian tongue into Greek.

299. The difference of Isis from Osiris (sect. 268) resembles that of the moon from the sun; of the female from the male, of *natura naturata* (as the schoolmen speak) from *natura naturans*. But Isis, though mostly taken for

[1] Not in the early editions.

[2] In what respect is this supposed to be an 'advantage'? Cf. sect. 301, 339.

[3] *De Anima Mundi*, cap. V. § 15. But this work is probably of late date.

nature, yet (as the Pagan divinities were very fluctuating things) it sometimes signified τὸ πᾶν. And we find in Mountfaucon an Isis of the ordinary form with this inscription, Θεοῦ παντός. And in the *mensa Isiaca*, which seems to exhibit a general system of the religion and superstition of the Egyptians, Isis on her throne possesseth the centre of the table. Which may seem to signify that the universe or τὸ πᾶν was the centre of the ancient secret religion of the Egyptians; their Isis or τὸ πᾶν comprehending both Osiris the Author of nature and his work.

300. Plato and Aristotle considered God as abstracted or distinct from the natural world[1]. But the Egyptians considered God and nature as making one Whole, or all things together as making one Universe. In doing which they did not exclude the intelligent mind, but considered it as containing all things. Therefore, whatever was wrong in their way of thinking, it doth not, nevertheless, imply or lead to Atheism[2].

301. The human mind is so much clogged and borne downward, by the strong and early impressions of sense (sect. 264), that it is wonderful how the ancients should have made even such a progress, and seen so far into intellectual matters, without some glimmering of a divine tradition. Whoever considers a parcel of rude savages left to themselves, how they are sunk and swallowed up in sense and prejudice, and how unqualified by their natural force to emerge from this state, will be apt to think

[1] Cf. sect. 323. This is illustrated by passages in Plato, e. g. *Repub.* Lib. VI. pp. 506, 508. See *Alτία im Philebus die persönliche Gottheit des Plato, oder Plato kein Pantheist.* Von G. F. Rettig, Bern 1866. This writer founds on passages in the *Philebus*. As regards Aristotle the case is not so clear. He seems to distinguish God from nature, but hardly to regard Deity as personal. His universe is eternal, and necessarily developed according to abstract ideals or ends. See *Metaph.* XI. 6–10, and X. 7, where he identifies metaphysics with theology; also Ps. *De Mundo*, VI. § 30, and Ps.-Plutarch, *De Placit. Philos.* Lib. I. 7.

In his early writings Berkeley discusses what we ought to mean by the *reality* we attribute to matter. In *Siris*, and so far in *Alciphron*, he advances to the deeper question of the meaning of 'real' when applied to God, and what constitutes atheism; but with less in *Siris* than in *Alciphron* about verifying the reality of Divine Being by sense and its suggestions, and more about finding God in the constitution of intuitive reason.

[2] Cf. sect. 288.

that the first spark of philosophy was derived from heaven; and that it was (as a heathen writer expresseth it) *θεοπαράδοτος φιλοσοφία*

302. The lapsed state of human kind is a thing to which the ancient philosophers were not strangers[1]. The *λύσις*, the *φυγή*, the *παλιγγενεσία*, shew that the Egyptians and Pythagoreans, the Platonists and Stoics, had all some notion of this doctrine, the outlines of which seem to have been sketched out in those tenets[2]. Theology and philosophy gently unbind the ligaments that chain the soul down to the earth, and assist her flight towards the sovereign Good. There is an instinct or tendency of the mind upwards, which sheweth a natural endeavour to recover and raise ourselves from our present sensual and low condition, into a state of light, order, and purity.

303. The perceptions of sense are gross: but even in the senses there is a difference[3]. Though harmony and proportion are not objects of sense, yet the eye and the ear are organs which offer to the mind such materials by means whereof she may apprehend both the one and the other. By experiments of sense we become acquainted with the lower faculties of the soul; and from them, whether by a gradual (sect. 275) evolution or ascent, we arrive at the highest. Sense supplies images to memory. These become subjects for fancy to work upon. Reason considers and judges of the imaginations. And these acts of reason become new objects to the understanding. In this scale, each lower faculty is a step that leads to one above it. And the uppermost naturally leads to the Deity; which is rather the object of intellectual knowledge than even of the discursive faculty, not to mention the sensitive.

[1] *Phædo*, e. g. *Theætetus*, p. 176, *Timæus*, pp. 30, 86, &c. Evil, as Plato represents it, is due to apostacy from an original good.

[2] *Phædo*, pp. 82–84. So Plotinus, whose life was an endeavour to unite, by philosophy, the divine in man with all-pervading Deity.

[3] Sect. 303-319 are among the most pregnant in *Siris*, suggesting the contrast and correlation of Sense and Intellect; the evanescent character of our material world; the innate notions, latent in the necessary constitution of Intellect; the dependence of space and the whole sensible world upon Mind—all interspersed with references to Pythagoras, Plato, Aristotle, and other ancient authorities. The 'scale' in sect. 303, distinguishes in human knowledge the sense-presentative element

There runs a Chain throughout the whole system of beings. In this Chain one link drags another. The meanest things are connected with the highest. The calamity therefore is neither strange nor much to be complained of, if a low sensual reader shall, from mere love of the animal life, find himself drawn on, surprised and betrayed, into some curiosity concerning the intellectual.

304. There is, according to Plato, properly no knowledge, but only opinion concerning things sensible and perishing (sect. 263, 264); not because they are naturally abstruse and involved in darkness, but because their nature and existence are uncertain, ever fleeting and changing. Or rather, because they do not in strict truth exist at all, being always generating or *in fieri*, that is, in a perpetual flux, without any thing stable or permanent in them to constitute an object of real science. The Pythagoreans and Platonics distinguish between τὸ γιγνόμενον and τὸ ὄν, that which ever generated and that which exists. Sensible things and corporeal forms are perpetually producing and perishing, appearing and disappearing, never resting in one state, but always in motion and change; and therefore, in effect, not one being but a succession of beings: while τὸ ὄν is understood to be somewhat of an abstract or spiritual nature, and the proper object of intellectual knowledge. Therefore, as there can be no knowledge of things flowing and unstable, the opinion of Protagoras and Theætetus, that sense was science, is absurd[1]. And indeed nothing is more evident than that the apparent sizes and shapes, for instance, of things are in a constant flux, ever differing as they are viewed at different distances, or with glasses more or less accurate. As for those absolute magnitudes and figures, which certain Cartesians and other moderns suppose to be in things; that must seem a vain supposition; to whoever

(αἴσθησις); the representative, in memory and imagination (φαντασία); and discursive thought or inference (διάνοια)—all culminating in intuitive reason (νοῦς), and 'intellectual knowledge.' Logically distinguishable, these elements are in fact inseparable, although they appear in varying proportions in different persons, and in the same person at different times.

[1] *Theætetus*, p. 154. The reference is to the *homo mensura* of Protagoras, argued against by Plato, with whom God, not man, least of all any individual man, is the intellectual measure of the universe.

considers, it is supported by no argument of reason, and no experiment of sense.

305. As understanding perceiveth not, that is, doth not hear, or see, or feel, so sense knoweth not: and although the mind may use both sense and fancy, as means whereby to arrive at knowledge, yet sense or soul, so far forth as sensitive, knoweth nothing. For, as it is rightly observed in the *Theætetus* of Plato, science consists not in the passive perceptions, but in the reasoning upon them—*τῷ περὶ ἐκείνων συλλογισμῷ*[1].

306. In the ancient philosophy of Plato and Pythagoras, we find distinguished three sorts of objects:—In the first place, a form or species that is neither generated nor destroyed, unchangeable, invisible, and altogether imperceptible to sense, being only understood by the Intellect. A second sort there is, ever fluent and changing (sect. 292, 293), generating and perishing, appearing and vanishing; this is comprehended by Sense and Opinion. The third kind is Matter, which, as Plato teacheth, being neither an object of understanding nor of sense, is hardly to be made out by a certain spurious way of reasoning—*λογισμῷ τινι νόθῳ μόγις πιστόν*. (See his *Timæus*[2].) The same doctrine is contained in the Pythagoric treatise *De Anima Mundi*[3], which, distinguishing ideas, sensible things, and matter, maketh the first to be apprehended by Intellect, the second by Sense, and the last, to wit, Matter, *λογισμῷ νόθῳ*[4]. Whereof Themistius the Peripatetic[5] assigns the reason. For, saith he, that act is to be esteemed spurious, whose object hath nothing positive, being only

[1] *Theætetus*, p. 186. Sense is realised in thought; which last therefore cannot be derived from sense.

[2] Where he distinguishes indeterminate *materia prima* from the Divine Ideas, and from the Cosmos of determinate sensible things which results from their correlation.

[3] *De Anima Mundi*, cap. I. § 2, 6—formerly attributed to *Timæus* the Locrian. The words are:—*Τὰ δὲ ξύμπαντα, ἰδέαν, ὕλαν, αἰσθητόν τε, οἷον ἔκγονον τουτέων.* In the Platonic philosophy, the concrete sensible universe implies Idea or Form (*τὸ εἶδος*), and Matter (*τὸ ἄπειρον* and *τὸ ἕτερον* of Plato, and the *πρώτη ὕλη* of Aristotle). That phenomenal reality implies these two unphenomenal elements is an opinion with which Berkeley is, I think, more in sympathy in *Siris* than in his early works.

[4] What is here said of 'Matter' is elsewhere said of Space. Cf. sect. 319. It is 'the result of *λογισμὸς νόθος*.'

[5] P. 34, ed. Venet. 1554.

a mere privation, as silence or darkness. And such he accounteth Matter.

307. Aristotle maketh a threefold distinction of objects, according to the three speculative sciences. Physics he supposeth to be conversant about such things as have a principle of motion in themselves; Mathematics about things permanent but not abstracted; and Theology about Being abstracted and immoveable; which distinction may be seen in the ninth book of his *Metaphysics*[1]. Where by abstracted, χωριστόν, he understands separable from corporeal beings and sensible qualities.

308. That philosopher held that the mind of man was a *tabula rasa*[2], and that there were no innate ideas. Plato, on the contrary, held original ideas in the mind; that is, notions which never were or can be in the sense, such as being, beauty, goodness, likeness, parity. Some, perhaps, may think the truth to be this: that there are properly no *ideas*, or passive objects, in the mind but what were derived from sense: but that there are also besides these her own acts or operations; such are *notions*[3].

309. It is a maxim of the Platonic philosophy, that the soul of man was originally furnished with native inbred notions, and stands in need of sensible occasions, not absolutely for producing them, but only for awakening, rousing, or exciting into act what was already pre-existent, dormant, and latent in the soul; as things are said to be laid up in the memory, though not actually perceived until they happen to be called forth and brought into view by other objects. This notion seemeth somewhat different from that of innate ideas, as understood by those moderns who have attempted to explode them[4]. To understand

[1] See *Metaph.* Lib. V. c. 1; also Lib. X. c. 1.

[2] *De Anima*, Lib. III. c. 4. But the *tabula rasa* of Aristotle seems not inconsistent with the *potential* existence of the Ideas by which sensible things are determined—of which things the Ideas and potential Matter are co-constituents.

[3] In this section, we have a glimpse of Berkeley's later thoughts on Sense and Intellect—Matter and Idea—and their correlation—his later Idealism in short. The '*ideas* or passive objects,' of which Berkeley says so much in the *Principles* and the *Three Dialogues* of his Dublin life, are data of sense: *notions*, of which he began even then to speak, and the Divine Ideas of *Siris*, are latent in the mind of man, who participates in the Divine Intelligence.

[4] Especially Locke, who opens his *Essay* with an argument against 'innate ideas and principles,' ac-

and to be are, according to Parmenides, the same thing[1]. And Plato in his seventh Letter[2] makes no difference between *νοῦς* and *ἐπιστήμη*, mind and knowledge. Whence it follows that mind, knowledge, and notions, either in habit or in act, always go together.

310. And albeit Aristotle considered the soul in its original state as a blank paper[3], yet he held it to be the proper place of forms—*τὴν ψυχὴν εἶναι τόπον εἰδῶν* (sect. 269). Which doctrine, first maintained by others, he admits. under this restriction, that it is not to be understood of the whole soul, but only of the *νοητική*; as is to be seen in his third book *De Anima*[4]. Whence, according to Themistius in his commentary on that treatise, it may be inferred that all beings are in the soul. For, saith he, the forms are the beings. By the form every thing is what it is. And he adds, it is the soul that imparteth forms to matter; *τὴν ὕλην μορφῶσα ποικίλαις μορφαῖς*. Therefore they are first in the soul. He farther adds that the mind is all things, taking the forms of all things it becomes all things by intellect and sense. Alexander Aphrodisæus saith as much, affirming the mind to be all things, *κατά τε τὸ νοεῖν καὶ τὸ αἰσθάνεσθαι*. And this in fact is Aristotle's own doctrine, in his third book *De Anima*[5], where he also asserts, with Plato, that actual knowledge and the thing known are all one. *Τὸ δ' αὐτό ἐστιν ἡ κατ' ἐνέργειαν ἐπιστήμη τῷ πράγματι*. Whence it follows, that the things are where the knowledge is, that is to say, in the mind. Or, as it is otherwise expressed, that the soul is all things. More might be said to explain Aristotle's notion, but it would lead too far.

cording to his inadequate interpretation of innateness.

[1] *Frag.* V. 40, *τὸ αὐτὸ νοεῖν τε καὶ εἶναι.*

[2] P. 342. The *Epistles* are not now attributed to Plato.

[3] Cf. sect. 308, 315. So too Locke, 'Let us suppose the mind to be, as we say, white paper, void of all character, without any ideas—how comes it to be furnished?' *Essay*, II. 1. § 2. But Locke neglects Aristotle's distinction of potential and actual.

[4] C. 8, where Aristotle identifies the *αἰσθητικόν* with the *αἰσθητόν*, and the *ἐπιστημονικόν* with the *ἐπιστητόν*, through their forms (*εἴδη*)—the potential intellect being with him, as with Plato, the place of forms—*τόπος εἰδῶν*. For Themistius, see p. 35, ed. Venet. 1534.

[5] Cap. 7. See the preceding note. For the Aphrodisian, see *De Anima*, p. 139 (ed. Venet. 1534).

311. As to an absolute actual existence of sensible or corporeal things (sect. 264, 292, 294), it doth not seem to have been admitted either by Plato or Aristotle[1]. In the *Theætetus*[2] we are told that if any one saith a thing is, or is made, he must withal say, for what, or of what, or in respect of what, it is, or is made; for, that any thing should exist in itself or absolutely is absurd. Agreeably to which doctrine it is also farther affirmed by Plato, that it is impossible a thing should be sweet and sweet to nobody. It must, nevertheless, be owned with regard to Aristotle, that even in his *Metaphysics* there are some expressions which seem to favour the absolute existence of corporeal things. For instance, in the eleventh book[3], speaking of corporeal sensible things, what wonder, saith he, if they never appear to us the same, no more than to sick men; since we are always changing and never remain the same ourselves? And again, he saith, sensible things, although they receive no change in themselves, do nevertheless in sick persons produce different sensations and not the same. These passages would seem to imply a distinct and absolute existence of the objects of sense.

312. But it must be observed, that Aristotle distinguisheth a twofold existence—potential and actual. It will not therefore follow that, according to Aristotle, because a thing is, it must actually exist[4]. This is evident from the eighth book[5] of his *Metaphysics*, where he animadverts

[1] In sect. 311-319, Berkeley, in consideration of the transitoriness of the data of sense, and their implication of percipient sustaining mind, returns to the favourite problem of his youth—the meaning of *real existence* when predicated of the sensible world. He summons Plato and Aristotle as witnesses to the truth, that its existence is relative; that unperceived Matter and Space are absurd abstractions. Cf. *Principles of Human Knowledge*. 'Sensible things' are not to be confounded with the ἄπειρον of Plato, or the ὕλη of Aristotle.

[2] P. 160.

[3] The passage is in Lib. X. (XI.) cap. 6, where Aristotle argues against Protagoras, and in behalf of permanence in sensible things.

[4] For we cannot say that its *realisation* in individual percipients is necessarily implied in its *potential* existence in God.

[5] C. 3, in which potential (ἐν δυνάμει) is distinguished from actual existence (ἐν ἐνεργείᾳ, or ἐν ἐντελεχείᾳ); and the Megaric theory, limiting existence to the latter, is identified with the sceptical subjectivity of Protagoras. With Berkeley, when sensible things exist ἐν δυνάμει, they exist in the ever-living power of God. But what is to be understood by

on the Megaric philosophers, as not admitting a possible existence distinct from the actual: from whence, saith he, it must follow, that there *is* nothing cold, or hot, or sweet, or any sensible thing at all, where there is no *perception*. He adds that, in consequence of that Megaric doctrine, we can have no sense but while we actually exert it: we are blind when we do not see, and therefore both blind and deaf several times in a day.

313. The ἐντελέχειαι πρῶται of the Peripatetics, that is, the sciences, arts, and habits, were by them distinguished from the acts or ἐντελέχειαι δεύτεραι, and supposed to exist in the mind, though not exerted or put into act[1]. This seems to illustrate the manner in which Socrates, Plato, and their followers, conceive innate notions to be in the soul of man (sect. 309). It was the Platonic doctrine[2], that human souls or minds descended from above, and were sowed in generation; that they were stunned, stupified, and intoxicated by this descent and immersion into animal nature; and that the soul, in this ὀνείρωξις or slumber, forgets her original notions, which are smothered and oppressed by many false tenets and prejudices of sense. Insomuch that Proclus[3] compares the soul, in her descent invested with growing prejudices, to Glaucus diving to the bottom of the sea, and there contracting divers coats of seaweed, coral, and shells, which stick close to him, and conceal his true shape.

314. Hence, according to this philosophy, the mind of man is so restless to shake off that slumber, to disengage and emancipate herself from those prejudices and false opinions that so straitly beset and cling to her, to rub off those covers that disguise her original form, and to regain her primeval state and first notions: hence that perpetual struggle to recover the lost region of light, that ardent thirst and endeavour after truth and intellectual ideas; which she would neither seek to attain, nor rejoice in, nor know when attained, except she had some prenotion or

this sort of existence? Berkeley hardly recognises this question, and its difficulties for us.

[1] The *acquisition* of a habit implies previous potentiality, as well as the *manifestation* of the habit. Hence the first and second energies of the Peripatetics.

[2] *Timæus*, p. 52.

[3] *Comment. in Alcib. Plat. Prim.* —De Anima et Dæmone. A Latin edition by Ficinus, consisting of 'excerpta,' appeared in 1497, at Venice.

anticipation of them, and they had lain innate and dormant, like habits and sciences in the mind, or things laid up, which are called out and roused by recollection or reminiscence. So that learning seemeth in effect reminiscence[1].

315. The Peripatetics themselves distinguish between reminiscence and mere memory. Themistius observes that the best memories commonly go with the worst parts; but that reminiscence is most perfect in the most ingenious minds. And, notwithstanding the *tabula rasa* of Aristotle (sect. 308), yet some of his followers have undertaken to make him speak Plato's sense. Thus Plutarch the Peripatetic teacheth, as agreeable to his master's doctrine, that learning is reminiscence, and that the *νοῦς καθ' ἕξιν* is in children. Simplicius also, in his commentary on the third book of Aristotle, *περὶ ψυχῆς*, speaketh of a certain interior reason in the soul, acting of itself, and originally full of its own proper notions, *πλήρης ἀφ' ἑαυτοῦ τῶν οἰκείων γνωσίων*[2].

316. And, as the Platonic philosophy supposed intellectual notions to be originally inexistent, or innate in the soul (sect. 309, 314), so likewise it supposed sensible qualities to exist (though not originally) in the soul, and there only[3]. Socrates saith to Theætetus[4], You must not think the white colour that you see is in any thing without your eyes, or in your eyes, or in any place at all. And in the *Timæus*[5], Plato teacheth that the figure and motion of the particles of fire dividing the parts of our bodies

[1] On the Platonic doctrine, it follows that we *remember*, by contingent association, the contingencies of sense-experience; we are *reminiscent* of the 'intellectual ideas' or necessities that can be evolved by reflexion.

[2] In connexion with this section, see Themistius, *In De Memoria et Reminiscentia*, fol. 97 (ed. Venet. 1534); and Simplicius, *De Anima*, Lib. III. c. 9. To Simplicius, who lived in the sixth century, we owe valuable expositions of Aristotle, especially the *De Anima*. He attempts to reconcile Aristotle with Plato. 'Plutarch the Peripatetic' seems to be Plutarch son of Nestorius, the Neo-platonist, who is said to have written a commentary, now lost, on the *De Anima*. With Aristotle, reminiscence (*ἀνάμνησις*) implies, I think, not all that Plato symbolised by reminiscence of a life before birth.

[3] 'there' does not imply locality —*spacial* relation. Cf. sect. 329. The forms of knowledge are latent in sensuous perception: pure sensation is negation.

[4] *Theætetus*, pp. 184, 185.

[5] Pp. 61, 62.

produce that painful sensation we call heat. And Plotinus, in the sixth book of his second Ennead[1], observes that heat and other qualities are not qualities in the things themselves, but acts: that heat is not a quality, but act in the fire: that fire is not really what we perceive in the qualities, light, heat, and colour. From all which it is plain that whatever real things they suppose to exist independent of the soul, those were neither sensible things nor clothed with sensible qualities.

317. Neither Plato nor Aristotle by Matter, ὕλη, understood corporeal substance, whatever the moderns may understand by that word[2]. To them certainly it signified no positive actual being. Aristotle[3] describes it as made up of negatives, having neither quantity, nor quality, nor essence. And not only the Platonists and Pythagoreans, but also the Peripatetics themselves declare it to be known, neither by sense, nor by any direct and just reasoning, but only by some spurious or adulterine method, as hath been observed before. Simon Portius[4], a famous Peripatetic of the sixteenth century, denies it to be any substance at all; for, saith he, *Nequit per se subsistere, quia sequeretur, id quod non est in actu esse in actu.* If Jamblichus[5] may be credited, the Egyptians supposed Matter so far from including aught of substance or essence, that, according to them, God produced it by a separation from all substance, essence, or being, ἀπὸ οὐσιότητος ἀποχισθείσης ὑλότητος. That Matter is actually nothing, but potentially all things, is the doctrine of Aristotle, Theophrastus, and all the ancient Peripatetics[6].

318. According to those philosophers, Matter is only a *pura potentia*, a mere possibility. But Anaximander, successor to Thales, is represented as having thought

[1] Cap. 3.

[2] τὸ ἄπειρον, or τὸ ἕτερον of Plato—according to Hegel, a necessitated 'otherness.' What is popularly meant by matter, i. e. sensible things, is not to be confounded with the formless Matter of Aristotle—that dark, undefinable presupposition underlying this ordered world.

[3] *Metaph.* Lib. VI. c. 3.

[4] See the *De Rerum Naturalium Principiis* (1551), Lib. I. c. 11, of Simon Porta or Portius—a Neapolitan Professor of Philosophy at Pisa, and the most famous of the pupils of Pomponatius.

[5] *De Ægyptiorum Mysteriis.* See the paraphrase of Ficinus.

[6] *Metaph.* Lib. VI. c. 7. 15, Lib. VII. c. 1; *De Anima*, Lib. III. c. 5.

the supreme Deity to be infinite Matter. Nevertheless, though Plutarch[1] calleth it Matter, yet it was simply τὸ ἄπειρον, which means no more than infinite or indefinite. And although the moderns teach that Space is real and infinitely extended, yet, if we consider that it is no intellectual notion[2], nor yet perceived by any of our senses, we shall perhaps be inclined to think with Plato in his *Timæus*, that this also is the result of λογισμὸς νόθος, or spurious reasoning, and a kind of waking dream. Plato observes that we dream, as it were, when we think of place, and believe it necessary that whatever exists should exist in some place. Which place or space (sect. 250, 270), he also observes, is μετ' ἀναισθησίας ἁπτόν, that is, to be felt as darkness is seen, or silence heard, being a mere privation.

319. If any one should think to infer the reality, or actual being, of Matter from the modern tenet, that gravity is always proportionable to the quantity of matter, let him but narrowly scan the modern demonstration of that tenet, and he will find it to be a vain circle, concluding in truth no more than this—that gravity is proportionable to weight, that is, to itself. Since Matter is conceived only as defect and mere possibility; and since God is absolute perfection and act; it follows there is the greatest distance and opposition imaginable between God and Matter. Insomuch that a material God would be altogether inconsistent.

320. The force that produces, the intellect that orders, the goodness that perfects all things is the Supreme Being[3]. Evil, defect, negation, is not the object of God's

[1] *De Placit. Philos.* Lib. I. c. 3.

[2] With Berkeley *intellectual notions* and *ideas of sense* are constituent elements of our knowledge. In his early philosophy, he concerned himself chiefly with the former; in *Siris* with the latter. In his later as in his earlier philosophy he teaches that absolute Space is a negation; actualised in sensible extension—created—and dependent for its actual reality upon percipient mind. For Plato, see *Timæus*, p. 52; and cf. sect. 306.

[3] Sect. 320–329, in accumulating authorities favourable to the reference of all change ultimately to spiritual agency, suggest the manner of the relation of the physical Cosmos to the Universal Power; also the elasticity of our theistic conception, adapted to theological eclecticism, and to tolerance of diversity in theological expression. They also revert to the *anima mundi*.

creative power. From motion the Peripatetics trace out a first immoveable Mover. The Platonics make God author of all good, author of no evil, and unchangeable [1]. According to Anaxagoras, there was a confused mass of all things in one chaos; but Mind supervening, ἐπελθών, distinguished and divided them. Anaxagoras, it seems, ascribed the motive faculty to mind [2]; which mind some subsequent philosophers have accurately discriminated from soul and life, ascribing to it the sole faculty of intellection.

321. But still God was supposed the first Agent, the source and original of all things; which he produceth, not occasionally or instrumentally, but with actual and real efficacy. Thus the treatise *De Secretiore Parte Divinæ Sapientiæ secundum Ægyptios*, in the tenth book, saith of God, that he is not only the first Agent, but also that he it is who truly acts or creates, *qui vere efficit.*

322. Varro, Tully, and St. Augustin, understand the soul to be *vis*; the power or force that acts, moves, enlivens. Now although, in our conception, *vis*, or spirit, might be distinguished from mind, it would not thence follow that it acts blindly or without mind, or that it is not closely connected with intellect. If Plutarch [3] is to be trusted in his account of the opinions of philosophers, Thales held the mind of the world to be God; Democritus held the soul of the world to be an igniform deity (sect. 166, 168, 277); Pythagoras taught that God was the monad and the good, or τ' Ἀγαθόν; Socrates also and Plato pronounced him to be τὸ Ἕν (sect. 287), the single, self-originate One, essentially good. Each of which appellations and forms of speech directly tends to and determines in Mind, εἰς τὸν νοῦν σπεύδει, saith Plutarch.

323. Whence that author concludes, that, in the sense of those philosophers, God is a Mind, χωριστὸν εἶδος; not an abstract idea compounded of inconsistencies, and prescinded from all real things, as some moderns understand

[1] *Timæus*, pp. 29, 30. Whence then comes the suffering and moral evil which perplex us on this planet? Is it not through the power of *persons* to do evil, which is implied in the universe being a moral economy, for the progressive education of persons in goodness?

[2] i. e. *νοῦς*. See Diogen. Laert. Lib. II. c. 6; also Ps.-Plutarch, *De Placit.* Lib. I. c. 3.

[3] *De Placit. Philos.* Lib. I. c. 7; also Arist. *De Anima*, Lib. I. c. 2.

abstraction[1]; but a really existing Spirit, distinct or separate from all sensible and corporeal beings. And although the Stoics are represented as holding a corporeal deity, or that the very system of the world is God, yet it is certain they did not, at bottom, dissent from the forementioned doctrine; inasmuch as they supposed the world to be an animal (sect. 276, 279) consisting of soul or mind, as well as body.

324. This notion was derived from the Pythagoreans, who held the world, as Timæus Locrus[2] teacheth, to be one perfect animal, endued with soul and reason: but then they believed it to have been generated: whereas the Stoics looked on the world as the Supreme God, including therein mind or intellect. For the elementary fire, or, if one may so speak, the animal spirit of the world, seemeth, according to them, to have been the *vehicle* of the soul of the world[3] (sect. 277, 284), since they styled the Divinity πῦρ νοερόν (sect. 272), or intellectual fire.

325. The Egyptians, if we may credit the Hermaic writings, maintained God to be all things, not only actual, but possible. He is styled by them, That which is made and that which is unmade. And therein it is said, Shall I praise thee for those things thou hast made manifest, or for the things thou hast hidden? Therefore, in their sense, to manifest was to create; the things created having been before hidden in God.

326. Now, whether the νοῦς be abstracted from the sensible world, and considered by itself, as distinct from and presiding over the created system; or whether the whole Universe, including mind together with the mundane body, is conceived to be God (sect. 300), and the creatures to be partial manifestations of the Divine essence—there is no Atheism in either case, whatever misconceptions there may be; so long as Mind or Intellect is understood to preside over, govern, and conduct, the whole frame of things[4]. And this was the general prevailing opinion among the philosophers.

[1] Cf. *Principles*, Introd. sect. 6–17. See Arist. *Metaph.* Lib. XI. c. 7, 12.

[2] *De Anima Mundi*, cap. 2. See also Ps.-Plutarch, *De Placit. Philos.* Lib. I. c. 11. Cf. sect. 153 of *Siris*.

[3] 'and soul itself the vehicle of intellect or νοῦς'—in first edition.

[4] Cf. sect. 287, 300. We find similar language in the Alexandrian

327. Nor if any one, with Aristotle in his *Metaphysics*[1], should deny that God knows anything without himself—seeing that God comprehends all things, could this be justly pronounced an atheistical opinion. Nor even was the following notion of the same author to be accounted Atheism, to wit that there are some things beneath the knowledge of God, as too mean, base, and vile; however wrong this notion may be, and unworthy of the Divine perfection[2].

328. Might we not conceive that God may be said to be All in divers senses;—as he is the cause and origin of all beings; as the νοῦς is the νοητά, a doctrine both of Platonics and Peripatetics (sect. 309, 310); as the νοῦς is the place of all forms; and as it is the same which comprehends and orders (sect. 320) and sustains the whole mundane system. Aristotle declares that the Divine force or influence permeates the entire universe (sect. 173), and that what the pilot is in a ship, the driver in a chariot, the precentor in a choir, the law in a city, the general in an army, the same God is in the world[3]. This he amply sets forth in his book *De Mundo*; a treatise which, having been anciently ascribed to him, ought not to be set aside from the difference of style; which (as Patricius rightly observes), being in a letter to a king, might well be supposed to differ from the other dry and crabbed parts of his writings[4].

329. And, although there are some expressions to be

Fathers, and in Cudworth. Berkeley is satisfied to conceive God as immanent in nature and in spirit; provided there is practical acknowledgement of perfect Intelligence at the heart of the universe, the physical necessarily subordinate to the spiritual.

[1] Lib. XI. c. 6-9.

[2] Theism involves the absolute universality of Divine Providence or the adaptation of *all* that exists and happens to the Divine Ideal of progressive goodness in moral agents. Nothing accordingly can be too insignificant for recognition in the providential moral order.

[3] That God is Order (physical and moral) vivified or personified, not capricious interference with Order, is the profound lesson at once of philosophy and true religion. This theistic faith is *virtually* postulated in all human experience.

[4] Cap. VI. § 34. As already said, the *De Mundo* is not accepted as genuine. But see the reference to it in Cudworth's *Intellectual System*, Bk. IV. c. 26. Patricius (1529–97) was one of the Christian Platonists of his day, and a critical expositor of Aristotle. In his *Discussiones Peripateticæ*, he refers to the *De Mundo*.

met with in the philosophers, even of the Platonic and Aristotelic sects, which speak of God as mixing with, or pervading all nature and all the elements; yet this must be explained by force, and not by extension, which was never attributed to the mind (sect. 290, 293, 297, 319), either by Aristotle or Plato. This they always affirmed to be incorporeal: and, as Plotinus remarks[1], incorporeal things are distant each from other not by place, but (to use his expression) by *alterity*.

330. These disquisitions will probably seem dry and useless to such readers as are accustomed to consider only sensible objects. The employment of the mind on things purely intellectual is to most men irksome; whereas the sensitive powers, by constant use, acquire strength. Hence, the objects of sense more forcibly affect us (sect. 264, 294), and are too often counted the chief good. For these things men fight, cheat, and scramble. Therefore, in order to tame mankind, and introduce a sense of virtue, the best human means is to exercise their understanding, to give them a glimpse of another world, superior to the sensible, and, while they take pains to cherish and maintain the animal life, to teach them not to neglect the intellectual.

331. Prevailing studies are of no small consequence to a state, the religion, manners, and civil government of a country ever taking some bias from its philosophy; which affects not only the minds of its professors and students, but also the opinions of all the better sort, and the practice of the whole people, remotely and consequentially indeed, though not inconsiderably. Have not the polemic and scholastic philosophy been observed to produce controversies in law and religion? And have not Fatalism and Sadducism gained ground, during the general passion for the corpuscularian and mechanical philosophy, which hath prevailed for about a century? This, indeed, might usefully enough have employed some share of the leisure and curiosity of inquisitive persons. But when it entered the seminaries of learning, as a

[1] *Third Ennead*, Lib. VI. c. 15, 'by alterity,' τῇ ἑτερότητι—a remarkable term.

necessary accomplishment and most important part of education, by engrossing men's thoughts, and fixing their minds so much on corporeal objects, and the laws of motion, it hath, however undesignedly, indirectly, and by accident, yet not a little, indisposed them for spiritual, moral, and intellectual matters. Certainly had the philosophy of Socrates and Pythagoras prevailed in this age, among those who think themselves too wise to receive the dictates of the Gospel, we should not have seen interest take so general and fast hold on the minds of men, nor public spirit reputed to be γενναῖαν εὐήθειαν, a generous folly, among those who are reckoned to be the most knowing as well as the most getting part of mankind[1].

332. It might very well be thought serious trifling to tell my readers that the greatest men had ever a high esteem for Plato; whose writings are the touchstone[2] of a hasty and shallow mind; whose philosophy has been the admiration of ages; which supplied patriots, magistrates, and lawgivers to the most flourishing states, as well as fathers to the Church, and doctors to the schools. Albeit in these days the depths of that old learning are rarely fathomed; and yet it were happy for these lands if our young nobility and gentry, instead of modern maxims, would imbibe the notions of the great men of antiquity. But, in these freethinking times, many an empty head is shook at Aristotle and Plato, as well as at the Holy Scriptures. And the writings of those celebrated ancients are by most men treated on a foot with the dry and barbarous lucubrations of the schoolmen. It may be modestly presumed there are not many among us, even of those who are called the better sort, who have more sense, virtue, and love of their country than Cicero, who in a Letter to Atticus[3] could not forbear exclaiming,

[1] The eloquent appeal on behalf of a Spiritual, as contrasted with the, then and now, prevalent Mechanical, or Materialistic Philosophy, and the eloge of Plato, contained in this and the next section, is the prelude to the fragments of Platonic and Neo-platonic speculation regarding Triune Divine Being, which occupy the remaining sections of *Siris*.

[2] Sir J. Mackintosh applies this term to Berkeley's own philosophy. 'His immaterialism is chiefly valuable as a *touchstone* of metaphysical sagacity' (*Diss.* p. 208).

[3] *Epist.* XIV. 9.

O Socrates et Socratici viri! nunquam vobis gratiam referam. Would to God many of our countrymen had the same obligations to those Socratic writers! Certainly, where the people are well educated, the art of piloting a state is best learned from the writings of Plato. But among bad men, void of discipline and education, Plato, Pythagoras, and Aristotle themselves, were they living, could do but little good. Plato hath drawn a very humourous and instructive picture of such a state; which I shall not transcribe for certain reasons[1]. But whoever has a mind may see it, in the seventy-eighth page of the second tome of Aldus's edition of Plato's works.

333. Proclus, in the first book[2] of his Commentary on the Theology of Plato, observes that, as in the mysteries, those who are initiated at first meet with manifold and multiform gods, but, being entered and thoroughly initiated, they receive the Divine illumination, and participate the very Deity: in like manner, if the soul look abroad, she beholds the shadows and images of things; but returning into herself, she unravels and beholds her own essence: at first she seemeth only to behold herself; but having penetrated farther she discovers the mind. And again, still farther advancing into the innermost sanctuary of the soul, she contemplates the θεῶν γένος. And this, he saith, is the most excellent of all human acts, in the silence and repose of the faculties of the soul to tend upwards to the very Divinity; to approach and be closely joined with that which is ineffable and superior to all beings. When come so high as the first principle, she ends her journey and rests. Such is the doctrine of Proclus.

334. But Socrates in the First Alcibiades[3] teacheth,

[1] The passage here referred to is in *Repub.* Lib. VI. pp. 487 E–489 D, Εἶεν, εἶπον... διεληλύθαμεν, in which the position of the philosopher in the state is likened to that of the able steersman, among a rebellious crew. Berkeley's reason for not quoting it might have been the length of the passage. He could hardly have fancied that it might be applied to himself, and the government under which he lived.

[2] Cap. 3. We have here a rough version of the original; according to which all things are potentially in the soul, which is thus potentially omniscient.

[3] P. 33. The passage in Proclus, quoted in the preceding section, is a commentary on this part of the *First Alcibiades*, where Socrates has it that in knowing the reasonable soul and its ideas we know God, and thus in know-

on the other hand, that the contemplation of God is the proper means to know or understand our own soul. As the eye, saith he, looking steadfastly at the visive part or pupil of another eye, beholds itself, even so the soul beholds and understands herself, while she contemplates the Deity, which is wisdom and virtue, or like thereunto. In the Phædon [1], Socrates speaks of God as being τ' Ἀγαθόν and τὸ Δέον (sect. 260, 322); Plotinus [2] represents God as order; Aristotle [3] as law [4].

335. It may seem, perhaps, to those who have been taught to discourse about substratums, more reasonable and pious, to attribute to the Deity a more substantial being than the notional entities of wisdom, order, law, virtue, or goodness; which being only complex ideas, framed and put together by the understanding, are its own creatures, and have nothing substantial, real, or independent in them. But it must be considered that, in the Platonic system, order, virtue, law, goodness, and wisdom are not creatures of the soul of man, but innate, and originally existent therein, not as an accident in a substance, but as light to enlighten, and as a guide to govern. In Plato's style, the term *idea* doth not merely signify an inert inactive object of the understanding, but is used as synonymous with αἴτιον and ἀρχή, cause and principle [5]. According to that philosopher, goodness, beauty, virtue, and such like are not figments of the mind, nor mere mixed modes, nor yet abstract ideas in the modern sense,

ing God know ourselves. Plato thus maintains the divinity of the reasonable soul. The *First Alcibiades*, Platonic in its tone, is by many regarded as spurious.

[1] *Phædo*, p. 80.

[2] *Sixth Ennead*, Lib. VIII. ad finem; also *Fifth Ennead*, Lib. V. Cf. sect. 328, note 1, with this and the next note.

[3] *De Mundo*, cap. VI. § 36. Not Aristotle.

[4] This is a pregnant sentence. Is not God rightly conceived as, relatively to us, perfect Goodness, Order and Law vivified, and eternally operative? See next section.

[5] Note here the contrast between the sensuous 'ideas' of Berkeley's early writings, and the Divine Ideas of Plato which he now appreciates; by participation in which the relations of things are necessarily determined; and in which, as principles, speculative inquiry seeks its satisfaction. Physical science is the issue of man's tentative endeavours to resolve events in external nature under their rational rules of procedure. But its provisional generalisations, limited by the data of human experience in sense, are far short of the Divine Thought, which constructive Idealism has tried in vain to express fully in the concrete.

but the most real beings, intellectual and unchangeable: and therefore more real than the fleeting, transient objects of sense (sect. 306), which, wanting stability, cannot be subjects of science (sect. 264, 266, 297), much less of intellectual knowledge.

336. By Parmenides, Timæus, and Plato a distinction was made, as hath been observed already, between *genitum* and *ens*. The former sort is always generating or *in fieri* (sect. 304, 306), but never exists; because it never continues the same, being in a constant change, ever perishing and producing. By *entia* they understand things remote from sense, invisible and intellectual, which never changing are still the same, and may therefore be said truly to exist. Οὐσία, which is generally translated substance, but more properly essence, was not thought to belong to things sensible and corporeal, which have no stability; but rather to intellectual ideas, though discerned with more difficulty, and making less impression on a mind stupefied and immersed in animal life, than gross objects that continually beset and solicit our senses.

337. The most refined human intellect, exerted to its utmost reach, can only seize some imperfect glimpses of the Divine Ideas (sect. 313, 330), abstracted from all things corporeal, sensible, and imaginable. Therefore Pythagoras and Plato treated them in a mysterious manner, concealing rather than exposing them to vulgar eyes; so far were they from thinking that those abstract things, although the most real, were the fittest to influence common minds, or become principles of knowledge, not to say duty and virtue, to the generality of mankind.

338. Aristotle[1] and his followers have made a monstrous representation of the Platonic ideas; and some of Plato's own school have said very odd things concerning them. But if that philosopher himself was not read only, but studied also with care, and made his own interpreter, I believe the prejudice that now lies against him would soon wear off (sect. 309, 313), or be even converted into a high esteem for those exalted notions and fine hints that sparkle and shine throughout his writings; which seem to contain

[1] See, for instance, Aristotle's *Metaph.* Lib. I. c. 9, and the interpretation put by Aristotle, in well-known passages, upon the Platonic doctrine of the absoluteness of the Ideas. See also *Metaph.* XII. 4.

not only the most valuable learning of Athens and Greece, but also a treasure of the most remote traditions and early science of the East.

339. In the *Timæus*[1] of Plato mention is made of ancient persons, authors of traditions, and the offspring of the gods. It is very remarkable that, in the account of the creation contained in the same piece, it is said that God was pleased with His work, and that the night is placed before the day. The more we think, the more difficult shall we find it to conceive, how mere man, grown up in the vulgar habits of life, and weighed down by sensuality, should ever be able to arrive at science, without some tradition (sect. 298, 301, 302) or teaching, which might either sow the seeds of knowledge, or call forth and excite those latent seeds that were originally sown in the soul[2].

340. Human souls in this low situation, bordering on mere animal life, bear the weight and see through the dusk of a gross atmosphere, gathered from wrong judgments daily passed, false opinions daily learned, and early habits of an older date than either judgment or opinion. Through such a medium the sharpest eye cannot see clearly (sect. 292, 293, 294). And if by some extraordinary effort the mind should surmount this dusky region, and snatch a glimpse of pure light, she is soon drawn backwards, and depressed by the heaviness of the animal nature to which she is chained. And if again she chanceth, amidst the agitation of wild fancies and strong affections, to spring upwards, a second relapse speedily succeeds into this region of darkness and dreams.

341. Nevertheless, as the mind gathers strength by repeated acts, we should not despond, but continue to exert the prime and flower of our faculties, still recovering, and reaching on, and struggling, into the upper region, whereby our natural weakness and blindness may be in

[1] Pp. 23 and 37. Cf. sect. 298, 301, for illustrations of Berkeley's reverence for ancient philosophy, as a supposed repository of an original Divine Revelation. So Cudworth, and afterwards the Chevalier Ramsay.

[2] Spiritual ideas and principles that are latent in each human mind, make men responsive to their analogues, presented outwardly by tradition or in history. The outward revelation may thus awaken a corresponding inspiration in the individual.

some degree remedied, and a taste attained of truth and intellectual life.—Beside the constant prevailing opinion of the greatest men of antiquity, that there is both an universal Spirit, author of life and motion, and an universal Mind, enlightening and ordering all things, it was a received tenet among them, that there is also τὸ Ἕν or τ' Ἀγαθόν (sect. 322), which they looked on as the *Fons Deitatis*, the first hypostasis in the Divinity.

342. The ONE, or τὸ Ἕν, being immutable and indivisible, always the same and entire, was therefore thought to exist truly and originally, and other things only so far as they are one and the same, by participation of τὸ Ἕν.[1] This gives unity, stability, and reality, to things (sect. 264, 306). Plato describes God, as Moses[2], from His being. According to both, God is He who truly is, ὁ ὄντως ὤν. Change and division were esteemed defects or bad. Evil scatters, divides, destroys. Good, on the contrary, produceth concord and union, assembles, combines, perfects, and preserves entire. The several beings which compose the universe are parts of the same system; they combine to carry on one end, and perfect one whole. And this aptness and concurrence thereunto furnishes the partial particular idea of Good in the distinct creatures. Hence it might have come to pass that τ' Ἀγαθόν and τὸ Ἕν were regarded as one and the same.

343. Light and sight (saith Plato in the sixth book[3] of his Republic) are not the sun: even so truth and knowledge are not the good itself, although they approach

[1] The Platonic and Neo-platonic conception of God is touched in this section; also what finite personality means—a finite Ego in itself, in its relation to God, also to nature, including its own sentient organism. The speculation of the ONE belongs eminently to Parmenides, and to Plotinus and Proclus. In this and the following sections, Berkeley mixes up the opinions of Plato with those of earlier and later philosophers.

[2] *Exodus* III. 14. Some modern critics connect the name Jehovah (Yahwè) with *becoming* rather than with absolute, immutable Being—with development, in short; and orderly development, animated by Spirit. Unity in a necessary Trinity, is Berkeley's implied ultimate conception of τὸ Πᾶν.

[3] This section of *Siris* is a description of what Plato says in the *Republic*; though I do not think he says expressly that the One and the Good are the same, unless this may be inferred from the end of the second book of the *Republic*, and the end of the *Philebus*.

thereunto. And again, what the sun is in a visible place with respect to sight and things seen, that same is τ' ἀγαθόν or Good in an intelligible place, with respect to understanding and things understood. Therefore the Good or One is not the light that enlightens, but the source of that light.

344. Every moment produceth some change in the parts of this visible creation. Something is added, or diminished, or altered, in essence, quantity, quality, or habitude. Wherefore all generated beings were said by the ancients to be in a perpetual flux (sect. 304, 336). And that which, on a confused and general view, seems one single constant Being, shall upon a nearer inspection appear a continued series of different beings. But God remains for ever one and the same. Therefore God alone exists. This was the doctrine of Heraclitus, Plato, and other ancients.

345. It is the opinion of Plato and his followers[1] that in the soul of man, prior and superior to intellect, there is somewhat of a higher nature, by virtue of which we are One; and that by means of our one or unit, we are most closely joined to the Deity. And, as by our intellect we touch the Divine Intellect, even so by *our* τὸ ἕν or unit, the very flower of our essence, as Proclus expresseth it[2], we touch the first One.

346. According to the Platonic philosophy, *ens* and *unum* are the same. And consequently our minds participate so far of existence as they do of unity. But it should seem that Personality is the indivisible centre of the soul or mind; which is a monad so far forth as she is a person. Therefore Person is really that which exists; inasmuch as it participates the Divine Unity. In man the monad or indivisible is the αὐτὸ τὸ αὐτό, the self-same self, or very self; a thing in the opinion of Socrates, much and narrowly to be inquired into and discussed, to the end

[1] In this and the preceding section there is more than is found in Plato. Proclus, *In Theol. Plat.*, Lib. II. cap. 4-12, expounds and defends Plato's doctrine of the ONE, referring especially to passages in the *Parmenides*, *Republic*, *Philebus*, and *Sophista*. These chapters may have been in Berkeley's view, in this and the three foregoing sections.

[2] *In Theol. Plat.*, Lib. III. c. 4. In the first part of this book, Proclus speculates on the manner in which human souls participate in the One.

that, knowing ourselves, we may know what belongs to ourselves and to our happiness.

347. Upon mature reflexion, the person or mind of all created beings seemeth alone indivisible, and to partake most of unity[1]. But sensible things are rather considered as one than truly so, they being in a perpetual flux or succession, ever differing and various. Nevertheless, all things together may be considered as one universe (sect. 287, 288); one by the connexion, relation, and order of its parts, which is the work of mind, whose unit is, by Platonics, supposed a participation of the first τὸ Ἕν.

348. Socrates, in the *Theætetus* of Plato, speaketh of two parties of philosophers—the ῥέοντες, and οἱ τοῦ ὅλου στασιῶται: the flowing philosophers, who held all things to be in a perpetual flux, always generating and never existing; and those others who maintained the universe to be fixed and immovable[2]. The difference seems to have been this, that Heraclitus, Protagoras, Empedocles, and in general those of the former sect, considered things sensible and natural; whereas Parmenides and his party considered τὸ πᾶν, not as the sensible but as the intelligible world (sect. 293, 294, 295), abstracted from all sensible things.

349. In effect, if we mean by *things* the *sensible* objects, these, it is evident, are always flowing; but if we mean things purely *intelligible*, then we may say on the other hand, with equal truth, that they are immovable and unchangeable. So that those who thought the Whole, or τὸ Πᾶν, to be Ἕν ἑστώς, a fixed or permanent One, seem to have understood the Whole of real beings; which in their sense was only the intellectual world, not allowing reality of being to things not permanent[3].

350. The displeasure of some readers may perhaps be incurred, by surprising them into certain reflexions and inquiries for which they have no curiosity. But perhaps

[1] Our own continued personality and personal identity, revealed in memory, is, with Berkeley, our concrete type of all *sameness* and *unity*—that from which we originally derive the meaning of those terms.

[2] P. 181. On the 'flowing philosophers,' see Cudworth's *Eternal and Immutable Morality*, pp. 242, &c.

[3] Compare this with the conception of 'reality' in the *Principles*.

some others may be pleased to find a dry subject varied by digressions, traced through remote inferences, and carried into ancient times, whose hoary maxims (sect. 298, 301), scattered in this Essay, are not proposed as principles, but barely as hints to awaken and exercise the inquisitive reader, on points not beneath the attention of the ablest men. Those great men, Pythagoras, Plato, and Aristotle, the most consummate in politics, who founded states, or instructed princes, or wrote most accurately on public government, were at the same time most acute at all abstracted and sublime speculations; the clearest light being ever necessary to guide the most important actions. And, whatever the world thinks, he who hath not much meditated upon God, the human mind, and the *summum bonum*, may possibly make a thriving earthworm, but will most indubitably make a sorry patriot and a sorry statesman.

351. According to the nice metaphysics of those ancient philosophers, τὸ Ἕν[1], being considered as what was first and simplest in the Deity, was prescinded even from entity, to which it was thought prior and superior; and is therefore by the Platonics styled super-essential. And in the Parmenides it is said, τὸ Ἕν doth not exist[2]; which might seem to imply a negation of the Divine Being. The truth is, Zeno and Parmenides argued that a thing existing in time was older and younger than itself; therefore the constant immutable τὸ Ἕν did not exist in time: and if not in time, then in none of the differences of time past, present, or to come; therefore we cannot say that it was, is, or will be. But, nevertheless, it is admitted, in the same Parmenides, that τὸ νῦν is everywhere present to

[1] The contemplation of τὸ Ἕν, or that ineffable Hypostasis which is 'first and simplest' in Deity, suggests further speculation on Divine Being, as involving also Intellect and Life. This introduces the ultimate Trinity, after which *Siris* concludes, in sections of exquisite beauty. Cf. Cudworth's *Intellectual System*, Bk. IV. c. 36. That Plato taught a Trinity of Hypostases is now generally disallowed, and has long been, even in England. See Cæsar Morgan's *Investigation of the Trinity of Plato and of Philo-Judæus* (1795).

[2] This is one of the assumptions of Parmenides, when he unfolds his conception of the One. The dialogue appears to be a sort of dialectical entertainment, not containing the real views of Parmenides or of Plato.

τὸ Ἕν; that is, instead of a temporary succession of moments, there is one eternal Now, or *punctum stans*, as it is termed by the schoolmen.

352. The simplicity of τὸ Ἕν (the Father in the Pythagoric and Platonic Trinity) is conceived such as to exclude intellect or mind, to which it is supposed prior; and that hath created a suspicion of Atheism in this opinion: for, saith the learned Doctor Cudworth[1], shall we say that the first Hypostasis or Person is ἄνους and ἄλογος, senseless and irrational, and altogether devoid of mind and understanding? or would not this be to introduce a kind of mysterious Atheism? To which it may be answered, that whoever acknowledgeth the universe to be made and governed by an Eternal Mind cannot be justly deemed an Atheist (sect. 154, 276, 279, 287). And this was the tenet of those ancient philosophers. In the Platonic doctrine, the generation of the Νοῦς or Λόγος was not contingent but necessary; not temporary but from everlasting. There never was a time supposed wherein τὸ Ἕν subsisted without Intellect; the priority having been understood only as a priority of order or conception, but not a priority of age. Therefore, the maintaining a distinction of priority between τὸ Ἕν and Νοῦς doth not infer that the one ever existed without the other. It follows, therefore, that the Father, or τὸ Ἕν, may, in a certain sense, be said to be ἄνους without Atheism, or without destroying the notion of a Deity; any more than it would destroy the notion of a human soul, if we should conceive a distinction between self and intellect, or intellect and life[2]. To which we may

[1] 'Shall we say that the First Hypostasis or Person in the Platonic Trinity (if not the Christian also) is *ἄνους* or *ἄλογος*, senseless and irrational, and altogether devoid of mind or understanding? Or would not this be to introduce a certain kind of mysterious Atheism, and under pretence of magnifying and advancing the Supreme Deity, monstrously to degrade the same? For why might not senseless Matter be supposed to be the first original of all things, as well as a *senseless* incorporeal Being?' (Cudworth, *Intellectual System*, Bk. IV. ch. 36. p. 585, ed. 1678.) Cf. *Alciphron*, Dial. IV. sect. 17, 18; also the references to Archbishop King, Bishop Browne, and the writings attributed to the Areopagite Dionysius, on the amount of theological knowledge that is possible in a human intelligence.

[2] The so-called triune 'faculties' of the human soul are manifested in their distinguishable mental products. The analogy is applied to the triune manifestation of Deity, according to Plato and Plo-

farther add, that it is a doctrine of Platonics, and agrees with their master's tenets, to say that τὸ Ἕν, or the first Hypostasis, contains all Excellence and Perfection, whereof it is the original source, and is *eminenter*, as the schools speak, intellect and life, as well as goodness; while the second Hypostasis is essentially Intellect, and, by participation, goodness, and life; and the third, Life essentially, and, by participation, goodness, and intellect.

353. Therefore, the whole being considered, it will not seem just to fix the imputation of Atheism upon those philosophers who held the doctrine of τὸ Ἕν (sect. 287, 288); whether it be taken in an abstracted or collective, a metaphysical or merely vulgar meaning (sect. 300): that is, whether we prescind Unity from essence and intellect; since metaphysical distinctions of the divine attributes do not in reality divide them: or whether we consider the universal system of beings as One; since the union, connexion, and order of its members do manifestly infer a mind or intellect to be cause thereof.

354. The One, or τὸ Ἕν, may be conceived either by composition or division. For as, on the one hand, we may say the world or universe is One Whole, or One Animal; so we may, on the other hand, consider τὸ Ἕν by division or abstraction, as somewhat in the order of things prior to mind. In either sense there is no atheism, so long as mind is admitted to preside and direct the Animal; and so long as the *Unum*, or τὸ Ἕν, is supposed not to exist without mind (sect. 287, 288). So that neither Heraclitus, nor Parmenides, nor Pythagoras, nor Plato; neither the Egyptians, nor Stoics, with their doctrine of a Divine Whole or Animal; nor Xenophanes with his ἓν καὶ πᾶν, are justly to be accounted Atheists. Therefore, modern Atheism[1], be it of Hobbes, Spinosa, Collins[2], or whom you will, is not to be countenanced by the learning and great names of antiquity.

355. Plato teacheth[3] that the doctrine concerning the

tinus. So also Hegel, with whom the universal, the particular, and the singular correspond to Intellect, Feeling, and Will—the trinity of human consciousness.

[1] Atheism abstracts the universe from Omnipotent Goodness realised in living Mind.

[2] Collins, so often criticised by implication in *Alciphron* and elsewhere, is here named. He died fifteen years before *Siris* appeared.

[3] *Republic*, pp. 256, 257.

One or Unit is a means to lead and raise the mind to the knowledge of Him who truly is (sect. 294, 295). And it is a tenet both of Aristotle and Plato, that identity is a certain unity. The Pythagoreans also, as well as the Platonic philosophers, held *unum* and *ens* to be the same. Consistently with which, that only can be said to exist which is one and the same. In things sensible and imaginable, as such, there seems to be no unity, nothing that can be called one, prior to all act of the mind; since they, being in themselves aggregates, consisting of parts or compounded of elements, are in effect many. Accordingly, it is remarked by Themistius[1], the learned interpreter of Aristotle, that to collect many notions into one, and to consider them as one, is the work of intellect, and not of sense or fancy.

356. Aristotle himself, in his third book of the Soul[2], saith it is the mind that maketh each thing to be one, τὸ δὲ ἓν ποιοῦν, τοῦτο ὁ νοῦς ἕκαστον. How this is done, Themistius is more particular, observing that, as being conferreth essence, the mind, by virtue of her simplicity, conferreth simplicity upon compounded beings. And, indeed, it seemeth that the mind, so far forth as person, is individual (sect. 345, 346, 347); therein resembling the Divine One by participation, and imparting to other things what itself participates from above. This is agreeable to the doctrine of the ancients; however the contrary opinion of supposing *number* to be an original primary quality in things, independent of the mind, may obtain among the moderns[3].

357. The Peripatetics taught that in all divisible things there was somewhat indivisible, and in all compounded things somewhat simple. This they derived from an act of the mind. And neither this simple indivisible unit, nor any sum of repeated units, consequently no number, can be separated from the things themselves, and from the operation of the mind. Themistius goeth so far as to affirm that it cannot be separated from the words or signs; and, as it cannot be uttered without them, so, saith he, neither can it be conceived without them. Thus much

[1] In his Commentary on the *De Anima*, Lib. III.

[2] C. 6, where Aristotle teaches how error becomes possible. Cf. the commentary of Themistius.

[3] As with the Cartesians and Locke.

upon the whole may be concluded, that, distinct from the mind and her operations, there is in created beings neither unit nor number[1].

358. Of inferior beings the human mind, self, or person, is the most simple and undivided essence (sect. 347). And the Supreme Father is the most perfect One. Therefore the flight of the mind towards God is called by the Platonics φυγὴ μόνου πρὸς μόνον. The Supreme Being, saith Plotinus[2], as he excludes all diversity, is ever alike present. And we are then present to Him, when, recollected and abstracted from the world and sensible objects, we are most free and disengaged from all variety (sect. 268). He adds that in the intuition of the Supreme Deity the soul finds her wished-for end and repose; which that philosopher calls awaking out of his body into himself.

359. In the tenth book of the *Arcane*, or *Divine Wisdom of the Egyptians*[3], we are taught that the Supreme Being is not the cause of any created thing; but that he produced or made the Word; and that all created beings were made by the Word; which is accordingly styled the Cause of all causes: and that this was also the doctrine of the Chaldeans. Plato, likewise, in his Letter[4] to Hermias, Erastus, and Coriscus, speaks of God, the ruler and cause of all things, as having a Father: and, in his *Epinomis*[5], he expressly teacheth that the Word or Λόγος made the world. Accordingly, Saint Augustine, in his Commentary on the beginning of Saint John's Gospel, having declared that Christ is the Wisdom of God by which all things were made, observes that this doctrine was also found in the writings of philosophers, who taught that God had an only begotten Son, by whom are all things.

360. Now, though Plato had joined with an imagination the most splendid and magnificent, an intellect not less deep and clear; yet it is not to be supposed that either he or any other philosophers of Greece or the East had

[1] Cf. *New Theory of Vision*, sect. 109, also *Principles*, sect. 12, 13, with this and the two preceding sections—the earlier with the latest expression of his thought on this subject.

[2] *Fifth Ennead*, Bk. V. c. 9.

[3] Cf. sect. 288.

[4] Epist. VI. p. 323 — not now assigned to Plato.

[5] P. 978. The *Epinomis* is not regarded as genuine.

by the light of nature obtained an adequate notion of the holy Trinity; nor even that their imperfect notion, so far as it went, was exactly just; nor perhaps that those sublime hints, which dart forth like flashes of light in the midst of a profound darkness, were originally struck from the hard rock of human reason; but rather derived, at least in part, by a Divine tradition, from the Author of all things (sect. 298, 301). It seems a remarkable confirmation of this, what Plotinus observed in his fifth Ennead[1], that this doctrine of a Trinity—Father, Mind, and Soul—was no late invention, but an ancient tenet.

361. Certain it is that the notion of a Trinity is to be found in the writings of many old heathen philosophers; that is to say, a notion of Three Divine Hypostases. Authority, Light, and Life did, to the eye of reason, plainly appear to support, pervade, and animate the mundane system or Macrocosm. The same appeared in the microcosm[2], preserving soul and body, enlightening the mind, and moving the affections. And these were conceived to be necessary universal principles; co-existing and co-operating, in such sort as never to exist asunder, but on the contrary to constitute One Sovereign of all things. And, indeed, how could power or authority avail or subsist without knowledge? or either without life and action?

362. In the administration of all things, there is Authority to establish, Law to direct, and Justice to execute. There is first the source of all perfection, or *Fons Deitatis*; secondly, the supreme Reason, order, or λόγος; and lastly, the Spirit which quickens and inspires. We are sprung from the Father, irradiated or enlightened by the Son, and moved by the Spirit. Certainly, that there is Father, Son, and Spirit; that these bear analogy to the sun, light,

[1] *Fifth Ennead*, Bk. I. c. 5. Ficinus, in his Commentary, here says:—'Pythagorici fingunt, in quadam quasi processione ipsius Unius, oriri Binarium, in quodam Binarii termino Ternarium suboriri, similiterque deinceps: Platonici similiter de prima essentia judicant.'

[2] Human consciousness is in a manner *triune*—involving the elements of Sensibility, Intellect, and Will. These three are in different proportions in different persons, but they coexist and co-operate in all. Intellect in man also involves a sort of *triunity* — Sense, Ideation, and Reason, discursive and intuitive.

and heat; and are otherwise expressed by the terms Principle, Mind, and Soul; by One or τὸ Ἕν, Intellect, and Life; by Good, Word, and Love; and that generation was not attributed to the second Hypostasis, the Νοῦς or Λόγος, in respect of time (sect. 352), but only in respect of origin and order, as an eternal necessary emanation;—these are the express tenets of Platonists, Pythagoreans, Egyptians, and Chaldeans.

363. Though it may be well presumed there is nothing to be found on that sublime subject in human writings which doth not bear the sure signatures of humanity; yet it cannot be denied that several Fathers of the Church have thought fit to illustrate the Christian doctrine of the holy Trinity, by similitudes and expressions borrowed from the most eminent heathens, whom they conceived to have been no strangers to that mystery; as hath been plainly proved by Bessarion[1], Eugubinus[2], and Doctor Cudworth[3].

364. Therefore, how unphilosophical soever that doctrine may seem to many of the present age, yet it is certain that men of greatest fame and learning among the ancient philosophers held a Trinity in the Godhead. It must be owned, that upon this point some later Platonists of the Gentile world seem to have bewildered themselves (as many Christians have also done), while they pursued the hints derived from their predecessors with too much curiosity.

365. But Plato himself considered that doctrine as a venerable mystery, not to be lightly treated of, or rashly divulged. Wherefore in a Letter to Dionysius[4], he writes

[1] Cardinal Bessarion (1395–1470), the learned Platonist. See his *Adversus Calumniatorem Platonis*, Lib. II. c. 3.

[2] In the treatise *De Perenni Philosophia* (1540), Lib. II. c. 7–18, of Augustinus Steuchus, Eugubinus (i. e. of Iguvium, now Gubbio, in Central Italy). He was born in the end of the fifteenth century, and died in 1550. This Cretan bishop and Platonising divine gathered into the treatise referred to a medley of illustrations of the harmony of Eastern and Greek philosophy with Christianity, as to the Divine Trinity in Unity, creation, and the immortality of souls. Berkeley seems to have studied the *De Perenni Philosophia*, a curious and little-known book.

[3] See *Intellectual System*, Bk. IV. c. 36.

[4] Epist. II. p. 312—not Plato's. See the comment on this passage, in the second book of Proclus on the Theology of Plato, quoted in Taylor's Plato.

(as he himself professeth) enigmatically and briefly in the following terms, which he giveth for a summary of his notion concerning the Supreme Being, and which, being capable of divers senses, I leave to be deciphered by the learned reader:—*Περὶ τὸν πάντων βασιλέα πάντ' ἐστί, καὶ ἐκείνου ἕνεκα πάντα, καὶ ἐκεῖνο αἴτιον ἁπάντων τῶν καλῶν. δεύτερον δέ, περὶ τὰ δεύτερα, καὶ τρίτον περὶ τὰ τρίτα.* Plato enjoins Dionysius, over and over, with great earnestness, not to suffer what he communicates concerning the mysteries of the Divine nature to fall into illiterate or vulgar hands, giving it withal as a reason for this caution, that nothing would seem more ridiculous or absurd to the common run of mankind. He adds that, in regard writings might miscarry, the prudent way was to write nothing at all on those matters, but to teach and learn them by word of mouth: for which reason, saith he, I have never wrote anything thereon; nor is there, nor shall there ever be, anything of Plato's extant on the subject. He farther adds, as for what hath been now said, it belongs all to Socrates.

366. And, indeed, what this philosopher in his *Phædrus*[1] speaketh of the super-celestial region, and the Divinity resident therein, is of a strain not to be relished or comprehended by vulgar minds; to wit, Essence, really existent, object of intellect alone, without colour, without figure, without any tangible quality. He might very justly conceive that such a description must seem ridiculous to sensual men.

367. As for the perfect intuition of divine things, that he supposeth to be the lot of pure souls, beholding by a pure light, initiated, happy, free and unstained from those bodies, wherein we are now imprisoned like oysters. But, in this mortal state, we must be satisfied to make the best of those glimpses within our reach (sect. 335, 337). It is Plato's remark, in his *Theætetus*[2], that while we sit still we are never the wiser; but going into the river, and moving up and down, is the way to discover its depths and shallows. If we exercise and bestir ourselves, we may even here discover something.

368. The eye by long use comes to see even in the

[1] Pp. 246–258. Cf. *Sympcsium*, p. 211. [2] P. 200.

darkest cavern: and there is no subject so obscure but we may discern some glimpse of truth by long poring on it. Truth is the cry of all, but the game of a few. Certainly, where it is the chief passion, it doth not give way to vulgar cares and views; nor is it contented with a little ardour in the early time of life; active, perhaps, to pursue, but not so fit to weigh and revise. He that would make a real progress in knowledge must dedicate his age as well as youth, the later growth as well as first fruits, at the altar of Truth.

Cujusvis est errare; nullius nisi insipientis in errore perseverare.
Cic. [*Orat. Philip.* XII. 2.]

THREE LETTERS TO THOMAS PRIOR, ESQ.

AND

A LETTER TO THE REV. DR. HALES

ON THE

VIRTUES OF TAR-WATER

First published in 1744–1747

LETTER

TO THOMAS PRIOR, ESQ.[1]

CONTAINING SOME FARTHER REMARKS ON THE VIRTUES OF TAR-WATER, AND THE METHODS FOR PREPARING AND USING IT[2]

Non sibi, sed toti.

'Nothing is more difficult and disagreeable than to argue men out of their prejudices; I shall not, therefore, enter into controversies on this subject, but, if men dispute and object, shall leave the decision to Time and Trial.'—*Siris*, Sect. 68.

1. AMONG the great numbers who drink Tar-water in Dublin, your letter informs me, there are [3 some] that make or use it in an undue manner. To obviate [4 these]

[1] 'T— P—, Esq.,' in the original edition.

[2] This *Letter* to Thomas Prior the Irish patriot and Berkeley's old friend, was published in Dublin (reprinted at the same time in London, 'for M. Cooper, at the Globe in Paternoster Row, price sixpence'), in July, 1744, about three months after the first appearance of *Siris*. Appended to it was *An Answer to a supposed Physician's Letter to the Right Reverend the Bishop of Cloyne, occasioned by his Treatise on the Virtues of Tar-water.* The *Physician's Letter* had been published in May, 1744.

Berkeley's *Letter* was a contribution to 'the Tar-water Controversy' of 1744 and several years following — a controversy occasioned by the sudden and extraordinary popularity of the proposed medicine, and by its claim to be a Panacea or Catholicon, due to *Siris*. It was a medical, not a metaphysical controversy; the medicinal virtues of Tar-water being the only question discussed. See Editor's Preface to *Siris*.

A second edition of this *Letter* appeared along with the *Second Letter*, in May, 1746, as an Appendix to a new edition of Mr. Prior's *Authentic Narrative of the Success of Tar-water.* The second motto (*Siris*, sect. 68) was added in the second edition.

[3] 'several'—in first edition.

[4] 'those'—in first edition.

inconveniences, and render this water as generally useful as possible, you desire I would draw up some rules and remarks in a small compass, which accordingly I here send you.

2. [[1] Pour a gallon of cold water on a quart of liquid tar; stir, mix, and work them thoroughly together; with a wooden ladle, or flat stick, for the space of five or six minutes. Then let the vessel stand close covered three days and nights, that the tar may have full time to subside. After which, having first carefully skimmed it without moving the vessel, pour off the clear water, and keep it in bottles, well corked for use. This method will produce a liquor stronger than that first published in *Siris*, but not offensive, if carefully skimmed.] It is a good general rule, but, as stomachs and constitutions are various, it may admit of some latitude. Less water or more stirring makes it stronger, as more water or less stirring makes it weaker. [[2] It is to be noted that if several gallons are made at once in the same vessel, you must add five or six minutes' stirring for every gallon. Thus two gallons of water and two quarts of tar require ten or twelve minutes' stirring.]

3. The same tar will not do so well a second time, but may serve for other common uses: the putting off tar that hath been used for fresh tar would be a bad fraud. To prevent which, it is to be noted that tar already used is of a lighter brown than other tar. The only tar that I have used is that from our northern Colonies in America, and that from Norway; the latter, being thinner, mixeth easier with water, and seems to have more spirit. If the former be made use of (as I have known it with good success), the tar-water will require longer stirring to make it.

4. Tar-water, when right, is not paler than French, nor deeper colour than Spanish white wine, and full as clear; if there be not a spirit very sensibly perceived

[1] In the first edition, instead of the sentences within brackets, we have—'Put a gallon of cold water to a quart of tar, stir and work them strongly together, for about four minutes. Let the vessel stand close covered for eight and forty hours, that the tar may subside. Then pour off the clear water, and keep it in bottles, well corked, for use.' Cf. *Siris*, sect. 1.

[2] Not in the first edition.

in drinking, you may conclude the tar-water is not good; if you would have it good, see it made yourself. Those who begin with it little and weak may by habit come to drink more and stronger. According to the season, or the humour of the patient, it may be drank either cold or warm; [[1]in colics, I take it to be best warm. If it disgusts a patient warm, let him try it cold, and *vice versa*. If at first it create to some squeamish persons a little sickness at the stomach, or nauseating, it may be reduced both in quality and quantity. In general, small inconveniences are either removed, or borne with small trouble;] it lays under no restraint as to air, exercise, clothes, or diet, and may be taken at all times in the year.

5. As to the quantity in common chronical indispositions, one pint of tar-water a day may suffice, taken on an empty stomach, at two or four times, to wit, night and morning, and about two hours after dinner and breakfast; more may be taken by strong stomachs. Alteratives in general, taken in small doses, and often, mix best with the blood—how oft or how strong each stomach can bear, experience will shew. But those who labour under great and inveterate maladies must drink a greater quantity; at least one quart [[2]every twenty-four hours], taken at four, six, or eight glasses, as best suits the circumstances and case of the drinker. All of this class must have much patience, and perseverance in the use of this as well as of all other medicines, which, if sure and safe, must yet, from the nature of things, be slow in the cure of inveterate chronical disorders. In acute cases, fevers of all kinds, it must be drank in bed, warm, and in great quantity, the fever still enabling the patient to drink perhaps a pint every hour, which I have known to work surprising cures. [[3]But it works so quick, and gives such spirits, that the patients often think themselves cured before the fever hath quite left them. Such, therefore, should not be impatient to rise, or apply themselves too soon to business, or their usual diet.

6. To some, perhaps, it may seem, that a slow altera-

[1] The words within brackets were not in the first edition.

[2] '*per diem*'—in first edition.

[3] What follows within brackets to the end of sect. 7, was added in the second edition.

tive in chronical cases cannot be depended on in fevers and acute distempers, which demand immediate relief. But I affirm that this same medicine, which is a slow alterative in chronical cases, I have found to be also a most immediate remedy, when copiously taken, in acute and inflammatory cases. It might indeed be thought rash to have tried it in the most threatening fevers and pleurisies without bleeding, which in the common practice would have been held necessary. But for this I can say, that I had patients who would not be bled, and this obliged me to make trials of tar-water without bleeding, which trials I never knew unsuccessful. The same tar-water I found a slow alterative, and a sudden febrifuge. If the reader is surprised, I own myself to be so too. But truth is truth, and from whatever hand it comes should be candidly received. If physicians think they have a right to treat of religious matters, I think I have an equal right to treat of medicine.

7. Authority I have no pretence to. But reason is the common birthright of all. My reasons I have given in *Siris*. My motives every one will interpret from his own breast. But he must own himself a very bad man, who in my case (that is, after long experience, and under full conviction of the virtues and innocence of tar-water) would not have done as much. All men are, I will not say allowed, but obliged, to promote the common benefit. And, for this end, what I could not in conscience conceal, that I do and shall publicly declare, maugre all the spleen and raillery of a world which cannot treat me worse than it hath done my betters.]

8. As the morning's draught is most difficult to nice stomachs, such may lessen, or even omit it at the beginning, or rather postpone it till after breakfast, and take a larger dose at night: the distance from meal-time need not be more than one hour, [[1] for common stomachs, when the liquor is well clarified and skimmed. The oil that floated on the top and was skimmed off should be carefully laid by, and kept for outward sores.] [[2] In the

[1] The first edition reads—'when the stomach is strong, or the glasses small: the oil that swims on the top may either be drank with the rest of the liquor, or skimmed off, and kept for outward sores.'

[2] Not in the first edition.

variety of cases and constitutions, it is not amiss that there should be different manners of preparing and taking tar-water. Trial will direct to the best.] Whether there be any difference between old tar and new tar, or which of all the various tars, produced from different trees, or in different parts of the world, is most medicinal, future trials must determine.

9. I have made a second sort of tar-water to be used externally—as a wash [[1] or lotion] for the itch, scabs, ulcers, [[1] evil,] leprosy, and all such foul cases, which I have tried with [[2] very good] success, and recommend it to the trial of others. For inveterate cases of that kind, tar-water should be drank, a quart every twenty-four hours, at [[2] four,] six, or eight glasses: and, [[3] after this hath been done at least for a fortnight, the lotion is to be] applied outwardly and warm, by bathing, fomenting, and steeping, and this several times in the twenty-four hours, to heal and dry up the sores, [[2] the drinking being still continued]. This water, for external use, is made in the following manner: Pour two quarts of boiling water on a quart of tar; stir and work it strongly with a flat stick or ladle, a full quarter of an hour: let it stand six hours, then pour it off, and keep it close covered for use. It may be made weaker or stronger as there is occasion.

[10. [4] From what I have observed of the lotion, I am inclined to think it may be worth while, in obstinate cutaneous ailments, leprosy, and weakness of limbs, to try a bath of tar-water; allowing a gallon of tar to every ten gallons of boiling-hot water; stirring the ingredients a full half hour; suffering the vessel to stand eight or ten hours, before the water is poured off; and using the bath a little more than milk warm. This experiment may be made in different proportions of tar and water. In Dublin many cases occur for trial which are not to be met with here in the country.]

11. My experiments have been made in various cases,

[1] Not in the first edition—in which also sect. 9 is part of the preceding one.

[2] Not in the first edition.

[3] In first edition—'at the same time the wash.'

[4] Sect. 10 was added to the second edition.

and on many persons; and I make no doubt its virtues will soon be more fully discovered; as tar-water is now growing into general use, though not without that opposition which usually attends upon novelty.—The great objection I find made to this medicine is that it promises too much. What, say the objectors, do you pretend to a *panacea*, a thing strange, chimerical, and contrary to the opinion and experience of all mankind? Now, to speak out, and give this objection or question a plain and direct answer—I freely own that I suspect tar-water is a panacea. I may be mistaken, but it is worth trial: for the chance of so great and general benefit, I am willing to stand the ridicule of proposing it. And, as the old philosopher cried aloud from the house-tops to his fellow-citizens—Educate your children, so, I confess, if I had a situation high enough, and a voice loud enough, I would cry out to all the valetudinarians upon earth—Drink tar-water.

12. Having thus frankly owned the charge, I must explain to you, that by a panacea is not meant a medicine which cures all individuals (this consists not with mortality), but a medicine that cures or relieves all the different species of distempers[1]. And, if God hath given us so great a blessing, and made a medicine so cheap and plenty as tar to be withal so universal in its effects, to ease the miseries of human life, shall men be ridiculed or bantered out of its use, especially when they run no risk in the trial? [[2]For I can truly affirm, that I never knew any harm attend it, more than sometimes a little nausea, which, if the liquor be well cleared, skimmed, and bottled, need not, I think, be apprehended.]

13. It must be owned I have not had opportunities of trying it myself in all cases; neither will I undertake to demonstrate *a priori* that tar-water is a panacea. But yet methinks I am not quite destitute of probable reasons, which, joined to what facts I have observed, induced me to entertain such a suspicion[1].

14. I [[3]knew] tar was used to preserve cattle from

[1] The claim of tar-water to be a *panacea*, which Berkeley offers only as a suggestion, is what is chiefly discussed in the Tar-water controversy, and to which the most plausible objections are made.

[2] Not in the first edition.

[3] 'Know' in first edition.

contagion; and this may be supposed to have given rise to that practice of drinking tar-water for a preservative against the small-pox. But, as the tar-water used for that purpose was made by mixing equal quantities of tar and water, it proved a most offensive potion: besides, as a fresh glass of water was put in for each glass that was taken out, and this for many days on the same tar, it follows that the water was not equally impregnated with the fine volatile spirit, though all alike strongly saturated with gross particles.

15. Having found this nauseous draught very useful against the small-pox to as many as could be prevailed on to take it, I began to consider the nature of tar[1]. I reflected that tar is a balsam flowing from the trunks of aged evergreens; that it resists putrefaction; that it hath the virtues of turpentine, which in medicine are known to be very great and manifold;—but I observed withal that turpentines or balsams are very offensive in the taking. I therefore considered distinctly the several constituent parts of balsams; which were those wherein the medicinal virtues resided, and, which were to be regarded rather as a viscous matrix to receive, arrest, and retain the more volatile and active particles; and, if these last could be so separated and disengaged from the grosser parts as to impregnate a clear and potable liquor, I concluded that such liquor must prove a medicine of great force and general use. I considered that nature was the best chemist and preparer of medicines, and that the fragrance and flavour of tar argued very active qualities and virtues.

16. I had, of a long time, entertained an opinion, agreeable to the sentiments of many ancient philosophers, *That Fire may be regarded as the Animal Spirit of this visible world*[2]. And it seemed to me that the attracting and secreting of this fire, in the various pores, tubes, and ducts of vegetables, did impart their specific virtues to each kind; that this same light or fire was the immediate instrumental or physical cause of sense and motion, and consequently of life and health to animals; that, on account

[1] Cf. *Siris*, sect. 10-39, with this section.

[2] This 'opinion' is the groundwork of a large part of *Siris*. Cf. especially sect. 152-230.

of this solar light or fire, Phœbus was in the ancient mythology reputed the god of medicine. Which light, as it is leisurely introduced, and fixed in the viscid juice of old firs and pines, so the setting it free in part, that is, the changing its viscid for a volatile vehicle, which may mix with water, and convey it throughout the habit copiously and inoffensively, would be of infinite use in physic, extending to all cases whatsoever—inasmuch as all distempers are in effect a struggle between the *vis vitæ* and the peculiar miasma or *fomes morbi*; and nothing strengthens nature, or lends such aid and vigour to life, as a cordial which doth not heat.

17. The solar light, in great quantity during the space of many successive years, being attracted and detained in the juice of ancient evergreens, doth form and lodge itself in an oil so fine and volatile as shall mix well with water, and lightly pass the *primæ viæ*, and penetrate every part and capillary of the organical system, when once exempt and freed from the grosser nauseous resin. It will not, therefore, seem unreasonable to whoever is acquainted with the medicinal virtues of turpentine in so many different distempers, for which it hath been celebrated both by ancient and modern physicians, and withal reflects on the nausea or clog that prevents their full operation and effect on the human body; it will not, I say, seem unreasonable to such a one to suppose that, if this same clog were removed, numberless cures might be wrought in a great variety of cases.

18. The *desideratum* was—how to separate the active particles from the heavy viscid substance which served to attract and retain them; and so to order matters that the vehicle of the spirit should not on the one hand be volatile enough to escape, nor on the other gross enough to offend. For the performing of this, I have found a most easy, simple, and effectual method, which furnisheth a potable inoffensive liquor, clear and fine as the best white wine, cordial and stomachic, to be kept bottled, as being endued with a very sensible spirit, though not fermented.

19. I tried many experiments as to the quantity of water, and the time of stirring and standing, in order to impregnate and clarify it, and after all, fixed on the fore-

mentioned receipt, as the most generally useful for making this salutiferous liquor well impregnated, and not offensive to common stomachs, and even drank with pleasure by many; in which the most medicinal and active particles, that is, the native salts [[1] spirit] and volatile oil [[2] of the balsam], being disentangled [[2] and separated] from its gross oil and viscous resin [[2] do, combined together, form a fine balsamic and vegetable soap, which not only] can [[1] freely] pass the [[3] stomach and] *primæ viæ*, but also insinuate [[3] itself into the minutest capillaries,] and pervade the whole animal [[4] system]; and that in such full proportion and measure as suiteth every case and constitution.

20. The foregoing general considerations put me upon making experiments in many various and unlike cases, which otherwise I should never have thought of doing, and the success answered my hopes. Philosophical principles led me to make safe trials, and on those trials is founded my opinion of the salutary virtues of tar-water; which virtues are recommended from, and depend on, experiments and matters of fact, and neither stand nor fall with any theories or speculative principles whatever. Howbeit, those theories, as I said, enlarged my views of this medicine, led me to a greater variety of trials, and thereby engendered and nourished my suspicion—that it is a panacea. I have been the more prolix in these particulars, hoping that, to as many as shall candidly weigh and consider them, the high opinion I conceive of this medicine will not seem altogether an effect of vain prepossession, or blind empiric rashness, but rather the result of free thought and inquiry, and grounded on my best reason, judgment, and experience. [[5] Much complaint is indeed made of the iniquity of the times: however, it is hoped they will not condemn one man's tar-water for another's pill or drop, any more than they would hang one man for another's having stolen a horse.]

21. Those who have only the good of mankind at heart will give this medicine fair play; if there be any who act

[1] Omitted in second edition.
[2] Not in first edition.
[3] In first edition—'themselves into the smallest ducts.'
[4] 'machine'—in first edition.
[5] Not in the early editions.

from other motives, the public will look sharp and beware. To do justice to tar-water, as well as to those who drink it, regard must be had to the particular strength and case of the patients. Grievous or inveterate maladies must not be treated as common cases. I cured a horrible case, a gangrene in the blood, which had broke out in several sores, and threatened speedy death, by obliging the person to drink nothing but this liquor for several weeks, as much and as often as his stomach would bear. Common sense will direct a proportionable conduct in other cases. But this must be left to the conscience and discretion of the givers and takers.

22. After all that can be said, it is most certain that a panacea sounds odd, and conveys somewhat shocking to the ear and sense of most men, who are wont to rank the Universal Medicine with the philosopher's stone, and the squaring of the circle; whereof the chief if not sole reason I take to be, that it is thought to be incredible the same things should produce contrary effects, as it must do if it cures opposite distempers. And yet this is no more than every day's experience verifies. Milk, for instance, makes some costive and others laxative. This regards the possibility of a panacea in general; as for tar-water in particular, I do not say it is a panacea, I only suspect it to be so—time and trial will shew.

23. But I am most sincerely persuaded, from what I have already seen and tried, that tar-water may be drank with great safety and success, for the cure or relief of most if not all diseases—of ulcers, itch, scald-heads, leprosy, the foul disease, and all foul cases, scurvies of all kinds, disorders of the lungs, stomach, and bowels, [[1]in rheumatic,] gouty, and nephritic ailments, [[1] megrims, inveterate head-aches,] pleurisies, peripneumonies, erysipelas, [[1] small-pox,] and all kinds of fevers, [[1] colics,] hysteric and all nervous cases, dropsies, decays, and other maladies. [[1] Note that for agues it should be drank warm and often, in small glasses, both in and out of the fit, and continued for several days to prevent a relapse.] Nor is it of use only in the cure of sickness; it is also useful to preserve health, and guard against infection; and in some measure

[1] Not in first edition.

even against old age, as it gives lasting spirits, and invigorates the blood. I am even induced, by the nature and analogy of things, and its wonderful success in fevers of all kinds, to think that tar-water may be very useful against the plague, both as a preservative and a cure.

24. But I doubt no medicine can withstand that execrable plague of distilled spirits, which do all, without exception, (the fire of the hot still imparting a caustic and coagulating quality to all distilled spirits [1], whatever the subject or ingredients may be), operate as a slow poison, preying on the vitals, and wasting the health and strength of body and soul; which pest of human kind is, I am told, gaining ground in this country, already too thin of inhabitants.

I am, &c.

[1] Cf. *Siris*, sect. 107, 108; and *Second Letter to Prior*, sect. 9.

A SECOND LETTER

TO THOMAS PRIOR, ESQ.

ON THE VIRTUES OF TAR-WATER[1]

1. YOUR attention to whatever promotes the public good of your country, or the common benefit of mankind, having engaged you in a particular inquiry concerning the virtues and effects of Tar-water, you are entitled to know what farther discoveries, observations, and reflexions I have made on the subject.

2. Tar-water, in the several editions of *Siris*, hath been directed to be made by stirring three, four, five, or six minutes, a gallon of water and a quart of tar. But, although it seems best made, for general use, within those limits, yet the stomach of the patient is the best rule whereby to direct the strength of the water; with a little more stirring, six quarts of good tar-water may be made from one of tar; and with eight minutes' stirring, I have known a gallon of tar-water produced from second-hand tar, which proved a good remedy in a very bad fever, when better tar could not be had. For the use of travellers, a tar-water may be made very strong, for instance, with one quart of water, and a quart of tar, stirred together for the space of five minutes. A bottle of this may serve long on a road, a little being put to each glass of common water, more or less, as you would have it stronger or weaker. Near two years ago, a quart of about this strength was given to an old woman, to be taken at one draught by direction of a young lady, who had consulted one in my

[1] First published in 1746, as an Appendix to Prior's *Authentic Narrative*, along with an amended edition of the *First Letter*.

family, about the method of preparing and giving tar-water, which yet she happened to mistake. But even thus, it did service in the main, though it wrought the patient violently all manner of ways: which shews that errors and excesses in tar-water are not so dangerous as in other medicines.

3. The best tar I take to be that which is most liquid, or first running from the billets of fir or pine which grew on the mountains: it hath a greater share of the anti-scorbutic vegetable juices, which are contained not only in the leaves and tender tops, but in all parts of the wood: and these, together with the salts of wood-soap, being in the composition of tar superadded to turpentine, render tar-water a medicine, if I am not mistaken, much more extensive and efficacious than any that can be obtained from turpentine alone.

4. The virtues of the wood-juices shew themselves in spruce-beer, made of molasses, and the black spruce-fir in the northern parts of America; and the young shoots of our common spruce-fir have been put to malt liquor in my own family, and make a very wholesome drink.

5. Tar-water seldom fails to cure, or relieve, when rightly made of good tar, and duly taken. I say, of good tar, because the vile practice of adulterating tar, and of selling the dregs of tar, or used tar for fresh, is grown frequent, to the great wrong of those who take it. Whoever hath been used to good tar-water can readily discern the bad by its flat taste, void of that warm cordial quality found in the former; it may also be expedient, for knowing fresh tar, to observe whether a fat oily scum floats on the top of the water, which is found to be much less, if any at all, on the second making of tar-water. This scum was directed to be taken off, not from its being apt to do harm when drank, but to render the tar-water more palatable to nice stomachs. Great quantities of tar are produced in Germany, Italy, and other parts of the world. The different qualities or virtues of these it may be worth while to try, and I wish the trial were made principally by observing, which giveth most sense of a lively cordial spirit upon drinking the water.

6. This medicine of tar-water worketh various ways, by urine, by perspiration, as a sudorific, carminative, cardiac,

astringent, detergent, restorative, alterative, and sometimes as a gentle purgative or emetic, according to the case or constitution of the patient, or to the quantity that is taken; and its operation should not be disturbed. I knew two brothers ill of a fever about the same time; it wrought on the one by copious sweating, on the other altogether by urine; and I have known it to act at different times differently, even on the same person, and in the same disorder; one while as a diaphoretic, or sudorific, another as a diuretic. Its general character is diuretic, which shews that it cleanseth the urinary passages, preventing thereby both stone and gravel, against which it hath been found very useful, and much safer than mineral waters, by reason of its balsamic healing quality.

7. Tar-water doth recover and impart vital heat, but imparts no inflaming heat. I have seen a wonderful cure wrought on a child about eight years old, and past all hopes, by pouring several spoonsful of tar-water down his throat, as he lay quite subdued by a most violent fever, without any appearance of sense or motion, the nostrils drawn back, the eyes fixed, the complexion deadly wan. And yet tar-water, forced down by spoonsful, seemed to kindle up life anew; and this after sage-tea, saffron, milk-water, Venice treacle, &c. had been used without any success.

8. This is of itself a sufficient cordial, friendly and congenial to the vital heat and spirits of a man. If, therefore, strong liquors are in the accustomed quantity superadded, the blood being already, by tar-water, sufficiently warmed for vital heat, the strong liquors superadded will be apt to overheat it, which overheating is not to be imputed to the tar-water, since, taken alone, I could never observe it attended with that symptom.

9. And, though it may be no easy matter to persuade such as have long indulged themselves in the free use of strong fermented liquors and distilled spirits to forsake their pernicious habits, yet I am myself thoroughly persuaded that, in the weakness or fatigue of body, or in low spirits, tar-water alone doth far surpass all those vulgarly-esteemed cordials, which heat and intoxicate, and which coagulate the fluids, and, by their caustic force, dry up, stiffen, and destroy the fine vessels and fibres of the

unhappy drinkers, obstructing the secretions, impairing the animal functions, producing various disorders, and bringing on the untimely symptoms of old age. Nothing doth so much obstruct the good effects of tar-water as the abuse of strong liquors. Where this is avoided, it seems no chronical malady can keep its ground or stand before tar-water, constantly and regularly taken, not even hereditary distempers, as the most inveterate king's evil, nor even the most confirmed gout; provided it be drank a quart a day, at six or eight glasses, and at all seasons, both in and out of the fit, and that for a great length of time, the longer the better. It is to be noted that in fits of the gout, colic, or fever, it should be always drank warm. On other occasions, warm or cold, as the patient likes.

10. The inference I make is, that those who expect health from tar-water have less need of any other cordial, and would do well to sacrifice some part of their pleasure to their health. At the same time, I will venture to affirm that a fever produced either from hard drinking, or any other cause, is most effectually and speedily subdued, by abstaining from all other cordials, and plentifully drinking of tar-water: for it warms the cold, and cools the hot; simple water may cool, but this, at the same time that it cools, gives life and spirit. It is, in truth, a specific for all kinds of fevers; the same medicine, which is a leisurely alterative in chronical disorders, being taken in larger quantities, is a speedy cure in acute ones.

11. Those who, without knowledge or experience of tar-water, have been so active and earnest to discredit its virtues, have much to answer for, especially with regard to acute inflammatory distempers, in which it doth wonders. It is in those disorders, so fatal and frequent, that I have had most opportunities of observing its virtues; nor can the world ever know the just value of this medicine, but by trying it in the like cases.

12. When patients are given over, and all known methods fail, it is allowed to try new remedies. If tar-water was tried in such cases, I do verily believe, that many patients might thereby be rescued from the jaws of death: particularly, I would recommend the trial of it in the most malignant and desperate fevers or small-pox, attended

with purple, livid, or black spots. It is my sincere opinion that warm tar-water, drank copiously, may often prove salutary, even in those deplorable cases.

13. My opinion is grounded on its singular virtues in correcting, sweetening, and invigorating the blood, and in curing cancers and gangrenes, or beginning mortifications, such as those spots do indicate. I have lately known it drunk with good success in a very painful and unpromising wound; and am persuaded that if it were drank plentifully, during the dressing of all sorts of dangerous wounds, it might assuage the anguish, and forward the cure; as it abates feverish symptoms, and, by rendering the blood balsamic and disposing the parts to heal, prevents a gangrene.

14. Tar itself is an excellent medicine, being spread on a cloth, and applied warm to an ulcer or wound. I have known the same applied to a very large and painful tumour, caused by a sprain or bruise, speedily assuage the pain, and reduce the swelling. I may add that tar (mixed with honey to make it less offensive, and) taken inwardly, is an admirable balsam for the lungs; and a little of this, taken together with tar-water, hastens its effect in curing the most obstinate and wasting coughs; and an egg-shell full of tar, swallowed and washed down with a quart of tar-water, night and morning, hath been found very useful for the same disorder in horses.

15. Sitting over the vapour of the heated lotion, described in my former letter, is excellent in the case of piles or fistula; especially if fomenting with the same lotion be added, as also anointing with the oil scummed from the top of tar-water. Tar-water hath been snuffed up the nostrils, with good success, for a great heaviness of the head and drowsiness. It is a very useful wash for weak, dry, or itching eyes; an excellent preservative for the teeth and gums; also a good drink and gargle for a throat: I may add that I have known it succeed in cases where it has been tried without hopes of success, particularly in deafness. I have known life sustained many days together only by drinking of tar-water, without any other nourishment, and without any remarkable diminution of strength or spirits; it may therefore be of singular use, and save many lives in the distress of famine at sea,

or in sieges, and in seasons of great scarcity. The virtue of tar-water, flowing like the Nile[1] from a secret and occult source, brancheth into innumerable channels, conveying health and relief, wherever it is applied; nor is it more easy and various in its use than copious in quantity. How great havoc, nevertheless, is made by the small-pox, raging like a plague in New England, and other parts of America, which yet abound with tar! And how many thousand sailors, in all parts of the world, are rotting by the scurvy with their remedy at hand!

16. Many in this town of Cloyne have, by the copious drinking of tar-water alone, been recovered of the most violent fevers, attended with the most threatening symptoms, and much heightened by relapses from mismanagement. It would be tedious to enumerate all the cases of this kind which have happened at Cloyne and in my own family; where many fevers, pleuritic as well as others, attended with violent stitches, difficulty of breathing, and spitting of blood, have been cured by tar-water: and this I can with truth affirm, that I never knew it regularly tried, in any inflammatory case, without success: but then it must be given in bed warm, and very copiously, with all due caution against cold, noise, and improper diet.

17. I have often observed, when a patient, on the first attack of a fever, hath betaken himself to his bed, and drank tar-water regularly and constantly, that he hath had such favourable symptoms, so good appetite, and so sound sleep, that the fever passed almost as nothing; nor was to be distinguished otherwise than by a quickness of pulse, a little feverish heat, and thirst. The more that patients in a fever drink, the better they find themselves; and their liking to tar-water grows with their want of it, by a certain instinct or dictate of nature; insomuch that I have known children in very high fevers, who, at other times, could hardly be prevailed on to drink a single glass, drink six or eight in an hour.

18. I can truly affirm that, for the cases within my own observation, inflammatory acute distempers cured by tar-water have been at least ten times the number of any

[1] [The Nile was by the ancient Egyptians called *Siris*, which word also signifies, in Greek, a chain, though not so commonly used as *Sira*.]—AUTHOR.

other. These indeed oftenest occur, as causing the chief destruction and general ravage of mankind: who are consequently debarred from the principal use and benefit of this medicine, so long as they give ear to the suggestions of those who, without any experience thereof, would persuade them it is of a heating or inflaming nature; which suggestion, as I am convinced myself, by long and manifold experience, that it is absolutely false, so may all others also be sufficiently convinced of its falsehood, by the wonderful fact, attested by a solemn affidavit[1] of Captain Drape at Liverpool; whereby it appears that of 170 negroes seized at once by the small-pox on the coast of Guinea one only died, who refused to drink tar-water; and the remaining 169 all recovered, by drinking it, without any other medicine, notwithstanding the heat of the climate, and the incommodities of the vessel. A fact so well vouched must, with all unbiassed men, outweigh the positive assertions of those who have declared themselves adversaries of tar-water, on the score of its pretended heating or inflaming quality[2].

19. The skill and learning of those gentlemen, in their profession, I shall not dispute; but yet it seems strange that they should, without experience, pronounce at once concerning the virtues of tar-water, and ascribe to it pernicious qualities, which I, who have watched its workings and effects for years together, could never discover. These three last years I have taken it myself without one day's intermission; others in my family have taken it near the same time, and those of different ages and sexes; several in the neighbourhood have done as much, all without any injury, and much benefit.

20. It is to be noted, the skin and the belly are antagonists; that is, the more passeth by perspiration, the less will pass another way. Medicines, therefore, which cause the patient to perspire will be apt to make him costive. Therefore, when tar-water worketh much by perspiration, the body may chance to be bound. But such symptom, though it should be attended with a little more than ordinary warmth, need not be dreaded by the patient; it being only a sign that his cure is carried on by driving the

[1] Captain Drape's 'affidavit,' appears in Prior's *Authentic Narrative of the Success of Tar-water*, pp. 18–20.

[2] Cf. *Siris*, sect. 7.

peccant matter through the skin; which is one of the ways whereby tar-water worketh its effect. And, when this effect or cure is wrought, the body of itself returneth to its former natural state; and, if some have been bound in their bodies, I have known others affected in a contrary manner upon drinking tar-water, as it hath happened to operate either in the shape of a diaphoretic, or of a gentle opening medicine. I have even known a costive habit more than once removed by it, and that when the case was inveterate, and other methods had failed.

21. I mentioned the foregoing article, upon calling to mind, that two or three patients had, for a time, complained of a binding quality in tar-water. I likewise remember that one in a high degree of the scurvy was discouraged from the use of tar-water, by its having caused an uneasy itching all over his body. But this was a good symptom, which shewed the peccant humours to be put in motion, and in a fair way of being discharged through the skin.

22. An humour or flatus put in motion, and dislodged from one part, often produceth new pains in some other part; and an efficacious medicine, as it produceth a change in the economy, may be attended with some uneasiness, which yet is not to be accounted a distemper, but only an effect or symptom of the cure.

23. The salts of tar-water have nothing of the fiery and corrosive nature of lixivial salts produced by the incineration of the subject; they not being fixed salts, made by the extreme force of fire, but volatile salts, such as preexisted in the vegetable, and would have ascended in smoke, if not prevented by the sods or covering of the billet piles. This, though already hinted in *Siris*, and plain from the manner of making tar, I have thought fit to repeat and inculcate, because, if duly attended to, it may obviate suspicions about tar-water, proceeding only from an ignorance of its nature.

24. Every step that I advanced in discovering the virtues of tar-water, my own wonder and surprise increased, as much as theirs to whom I mentioned them. Nor could I, without great variety and evidence of facts, ever have been induced to suspect that all sorts of ailments whatsoever it might relieve or cure, which at first sight may seem incredible and unaccountable; but, on maturer thought,

will perhaps appear to agree with, and follow from, the nature of things. For, it is to be noted that the general notion of a disease seemeth to consist in this—that what is taken in is not duly assimilated by the force of the animal economy; therefore it should seem whatever assists the *vis vitæ* may be of general use in all diseases, enabling nature either to assimilate or discharge all unsubdued humours and particles whatsoever. But the light or æther detained in the volatile oil which impregnates tar-water, being of the same nature with the animal spirit, is an accession of so much strength to the constitution, which it assists to assimilate or expel whatever is alien or noxious.

A LETTER

TO THOMAS PRIOR, ESQ.

CONCERNING

THE USEFULNESS OF TAR-WATER IN THE PLAGUE

WHEREIN ALSO IT IS CONSIDERED

WHETHER TAR-WATER, PREPARED WITH THE DISTILLED ACID OF TAR, SHOULD BE PREFERRED TO THAT MADE IN THE COMMON WAY, BY MIXING TAR WITH WATER AND STIRRING THEM TOGETHER[1]

'They provoked Him to anger with their own inventions, and the Plague brake in upon them.'—Ps. cvi. 29.

You observe, in a late letter of yours, that I had formerly hinted Tar-water might be useful in the Plague; and desire to know the reasons whereon my opinion was grounded, and that I would communicate my thoughts at large on the subject. I am the more willing to satisfy you in this particular, as the Plague now raging in Barbary hath in some measure alarmed the public, and I think it may not be amiss to contribute my mite of advice towards averting or lessening the present danger; and, as fear begets caution, to possess my countrymen with an apprehension of this, the greatest of all temporal calamities, sufficient to put them on their guard, and prepare them against the worst that can happen.

[1] First published in Dublin, and reprinted in London, 'for Innys, Hitch, and Cooper, Paternoster Row, and Davis in Holbourn,' in 1747, in the same pamphlet with Berkeley's *Letter* to Dr. Hales.

A learned physician of our own observes that the plague does not visit these Britannic islands oftener than once in thirty or forty years; and it is now above twice that time since we felt the hand of the destroying angel[1].

It is also the opinion of physicians that the infection cannot spread except there is a suitable disposition in the air to receive it; the signs of which are wet summers, leaves and fruits blasted, an unusual quantity of insects, epidemical distempers among the cattle, to which I presume may be added long easterly winds—all which signs seem to have discovered themselves pretty plainly in the course of this present year.

Beside these natural forerunners of a plague or pestilence in the air, it is worth observing that a prognostic may be also made from the moral and religious disposition of the inhabitants. Certainly that the *digitus Dei* (the τὸ θεῖον of Hippocrates) doth manifest itself in the plague was not only the opinion of mankind in general, but also in particular of the most eminent physicians throughout all ages down to our own. How far we of these islands have reason to expect this messenger of Divine vengeance will best appear if we take a view of the prevailing principles and practices of our times, which many think have long called aloud for punishment or amendment.

Analogy and probability prevail in medicine: these are the proper guides where experience hath not gone before. I knew that tar-water was useful to prevent catching the small-pox, and consequently that its nature was contrary to the taint or venom producing that distemper; and therefore I concluded that it might be usefully applied to cure the same, though I never heard nor knew that it had been applied to that purpose, and the success answered my hopes.

In like manner, having known the virtue of tar-water in preserving from epidemical infection, I conceive in general it may be useful for the cure of distempers caused by such infection. Besides, being very well assured that tar-water was sovereign in the cure of all sorts of fevers, I think it not unreasonable to infer that it may prove a successful

[1] In 1665—eighty-two years before this was written. The plague has not since visited these islands, unless in 1900, when a few cases were reported in Glasgow.

medicine for the plague, although I have never known it used in that distemper, forasmuch as the plague with all its symptoms may be considered as a species of fever, and hath been actually considered as such both by Hippocrates and Sydenham, not to mention others.

Having observed surprising effects of tar-water in the most deplorable cases, for instance, pleurisies, small-pox, spotted and erysipelatous fevers, I am induced to entertain great hopes of its success in pestilential fevers or plagues; which are also confirmed by its operating as a powerful diaphoretic and sudorific, when given warm and in great quantities. Add to this, that it frequently throws out pustules and ulcers, is apt to terminate the worst of fevers by an irruption of boils in various parts of the body; that it raises the spirits, is a great alexipharmacum and cordial, and must therefore be of the greatest use in malignant cases.

In cachexy, scurvy, gout, as well as in the close of fevers, I have often known tar-water cause troublesome eruptions or boils (the very method taken by nature in casting forth the venom of the plague) to break out in the surface of the body, expelling the morbific humours, the cause and relics of the disease, to the signal benefit of the patients; except such who, being frightened at the symptoms, have supposed the tar-water to produce those humours which it only drives out, and, in consequence of such their groundless suspicion, laid it aside, or perhaps took other medicines to hinder its effect, and thereby deprive themselves of the benefit they might otherwise have received.

In the plague are observed head-ache, drowsiness, anxiety, vigils, sinking of spirits, and weakness, for all which tar-water hath been found an effectual remedy. Bloody urine and spitting blood, which are also dangerous symptoms observed in the plague, have been often removed by the same medicine, which from numberless experiments I have found to be peculiarly fitted for purifying and strengthening the blood, and for giving it a due consistence, as well as a proper motion.

In the plague, pleurisies are esteemed mortal symptoms, and in the cure of these I never knew tar-water fail, if given warm in bed, a pint or more an hour, though the patient was neither bled nor blistered. The carbuncles

and spots which shew themselves in the plague are of a gangrenous nature, tending to mortification. And gangrenes I have known effectually cured by copious drinking of tar-water.

An erysipelas, which sheweth a degree of malignity nearest to the plague, is easily cured by plentiful drinking of tar-water. I knew a person who had been six weeks ill of an erysipelas under the care of a celebrated physician, during which time she struggled with many dangerous symptoms, and hardly escaped with life. This person was a year after seized again in the same manner, and recovered in a week, by the sole use of tar-water. Costiveness is reckoned a very hopeful prognostic in the plague; and it is also a symptom which often attends the drinking of tar-water, when it throws out the venom of a distemper through the skin.

Diseases of the same season generally bear some affinity to each other in their nature and their cure; and it may not be improper on this occasion to observe that the reigning distemper of the black cattle hath been often cured by tar-water, and would (I am persuaded) have done much less mischief, if the practice had been general to have given each distempered beast three gallons the first, two the second, and one the third day, in warm doses (from a pint to a quart), and at equal intervals.

Diemerbroeck[1] recommends in the first appearance of a plague the use of sudorifics, putting the patient to bed, and covering him warm, till a copious sweat be raised, the very method I constantly follow in the beginning of fevers, using no other medicine than tar-water; which, after numberless experiments, I take to be the best sudorific that is known, inasmuch as it throws out the morbific miasma, without either heating the patient or weakening him, the common effects of other sudorifics, whereas this, at the same time that it allays the feverish heat, proves a most salutary cordial, giving great and lasting spirits.

Upon the whole, I am sincerely persuaded that for the cure of the plague there cannot be a better method followed, more general for use, more easy in practice, and

[1] An eminent Dutch physician, who practised at Nimeguen during the great Plague there, in 1635–7. His work *De Peste* appeared in 1646.

more sure in effect, than to cover the patient warm in bed, and to make him drink every hour one quart of warm tar-water, of such strength as his stomach is able to bear; a thing not so impracticable as it may seem at first sight, since I have known much more drank in fevers, even by children, and that eagerly and by choice, the distemper calling for drink, and the ease it gave encouraging to go on. This for the cure; but I conceive that one quart *per diem* may suffice for prevention; especially if there be added an even temper of mind, and an exact regimen, which are both highly useful against the plague. For carbuncles and buboes I would recommend a liniment of the oil of tar, or a plaster of pitch mixed with water, which last was used by the vulgar in the Dutch plague described by Diemerbroeck.

It has pleased divine Providence to visit us not long since, first with famine, then with the sword; and if it should please the same good Providence yet farther to visit us for our sins, with the third and greatest of human woes, this, by God's blessing, is the course I mean to take for myself and family; and if generally practised, it would, I doubt not (under God), save the lives of many thousands; whereof being persuaded in my own mind, both from the many trials I have made of tar-water, and the best judgment and reasonings I could form thereupon, I think myself obliged to declare to the world what I am convinced of myself.

And I am the rather moved to this by the great uncertainty and disagreement among physicians, in their methods of treating the plague. Diemerbroeck, for instance, a physician of great experience in the Dutch plague that raged about eighty years ago, dissuades by all means from bleeding in that distemper. On the other hand, Sydenham recommends what the other disapproves. If we believe Dr. Sydenham, the free use of wine, as a preservative, hath thrown many into the plague who otherwise might have escaped. Dr. Willis, on the contrary, avers that he knew many who, being well fortified by wine, freely entered amongst the infected without catching the infection.

Bleeding cools, but at the same time weakens nature. Wine gives spirits, but heats withal. They are both,

therefore, to be suspected; whereas tar-water cools without weakening, and gives spirit without heating, a sure indication of its sovereign virtue in all inflammatory and malignant cases; which is confirmed by such numbers of instances that matter of fact keeps pace (at least) with reason and argument in recommending this medicine.

Plagues as well as fevers are observed to be of different kinds: and it is observed of fevers that, as they change their genius in different seasons, so they must be treated differently, that very method that succeeded in one season often proving hurtful in another. Now it is very remarkable, that tar-water has been known to vary its working, and wonderfully adapt itself to the particular case of the patient, a thing I frequently have experienced.

Last spring two children, a boy and a girl, the former ten years old, the latter eight years old, were seized with fevers; the boy had an inflammation in his breast. In less than two hours they drank each above five quarts of warm tar-water, which wrought them very differently, the girl as an emetic, the boy as a gentle purge, but both alike immediately recovered, without the use of any other medicine: of this I was an eye-witness, and I have found by frequent experience that the best way is, to let this medicine take its own course, not hindered nor interrupted by any other medicines; and, this being observed, I never knew it to fail so much as once, in above a hundred trials in all sorts of fevers.

Nevertheless, there are not wanting those who would insinuate that tar-water made in the common way contains noxious oils or particles of tar, which render it dangerous to those who drink it, a thing contrary to all my experience. This was the old objection made by those who opposed it from the beginning. But I am convinced, by innumerable trials, that tar-water is so far from doing hurt by any caustic or fiery quality, that it is, on the contrary, a most potent medicine for the allaying of heat, and curing of all inflammatory distempers. The perpetually returning to the same objection makes it necessary to repeat the same answer.

And yet some who are not afraid to argue against experience would still persuade us that the common tar-water is a dangerous medicine, and that the acid freed

from the volatile oil is much more safe and efficacious[1]: but I am of opinion that, being robbed of its fine volatile oil (which neither sinks to the bottom, nor floats at the top, but is throughout and intimately united with it, and appears to the eye only in the colour of tar-water); being robbed, I say, of this oil, it is my opinion it can be no cordial; which opinion (not to mention the reason of the thing) I ground on my own experience, having observed that the most acid water is the least cordial, so far am I from imputing the whole virtue to the acid, as some seem to think.

It seems not very reasonable to suppose that the caustic quality of tar-water (if such there was) should be removed or lessened by distillation, or that a still should furnish a cooler and better medicine than that which is commonly prepared by the simple affusion and stirring of cold water. However the ends of chemists or distillers may be served thereby, yet it by no means seemeth calculated for the benefit of mankind in general to attempt to make people suspect, and frighten them from the use of a medicine, so easily and so readily made, and everywhere at hand, of such approved and known safety, and, at the same time, recommended by cures the most extraordinary, on persons of all sexes and ages, in such variety of distempers, and in so many distant parts of Christendom.

By most men, I believe, it will be judged, at best, a needless undertaking, instead of an easy-tried medicine to introduce one more operose and expensive, unsupported by experiments, and recommended by wrong suppositions —that all the virtue is in the acid; and that the tar-water, being impregnated with volatile oil, is caustic, which are both notorious mistakes.

Though it be the character of resin not to dissolve or mix with water as salts do, yet it attracts some fine particles of essential oil, which serves as a vehicle for such acid salts; and the colour of the tar-water sheweth the fine oil, in which the vegetable salts are lodged, to be dissolved

[1] He probably refers to the recommendation of the acid alone, contained in *A Letter to the Rev. Dr. Hales, Concerning the Nature of Tar, and a method of obtaining its Medical Virtues free from its hurtful Oils*, by Andrew Reid (1747). Reid proposes to administer the acid entirely apart from the oil.

and mixed therein. The combination of two such different substances as oil and salt constitutes a very subtle and active medicine, fitted to mix with all humours, and resolve all obstructions, and which may properly be called an acid soap.

Tar-water operates more gently and safely, as the acid salts are sheathed in oil, and, thereby losing their acrimony, approach the nature of neutral salts, and so become more friendly to the animal system. By the help of a smooth insinuating oil, these acid salts are more easily and safely introduced into the fine capillaries. I may add, that the crasis of the blood is perfected by tar-water, being good against too great a solution and fluidity as a balsam, and against viscidity as a soap, all which entirely depends upon the mixture of oil with the acid, without which it could neither operate as a balsam nor a soap. Briefly, it was not mere acid or distilled water, or tincture of tar, but tar-water, as commonly made, by affusion and stirring of cold water upon tar, which hath wrought all those great cures and salutary effects, which have recommended it as a medicine to the general esteem of the world.

The mixture of volatile oil, which is or contains the spirit, is so far from noxious that it is the very thing that makes tar-water a cordial; this gives it a grateful warmth, and raiseth the spirits of the hysteric and hypochondriacal; this also, rendering the blood balsamic, disposeth wounds of all sorts to an easy cure; this also it is that fortifies the vitals, and invigorates nature, driving the gout to the extremities, and shortening the fits, till it entirely subdues that obstinate and cruel enemy, as it hath been often known to do; but acid alone is so far from being able to do this, that, on the contrary, the free use of acids is reckoned amongst the causes of the gout.

I never could find that the volatile oil drawn from tar by the affusion of cold water produced any inflammation, or was otherwise hurtful, not even though the water by longer stirring had imbibed far more of the oil than in the common manner, having been assured, that some of strong stomachs have drank it after twenty minutes' stirring, without any the least harm, and with very great benefit.

It hath been indeed insinuated that the oil was ordered to be skimmed off, because it is caustic and dangerous;

but this is a mistake. I myself, among many others, drank the tar-water for two years together, with its oil upon it; which never proved hurtful, otherwise than, as being somewhat gross, and floating on the top, it rendered the water less palatable, for which reason alone it was ordered to be skimmed.

It hath also been hinted that making tar-water the second time of the same tar was cautioned against, for that it was apprehended such water would prove too heating; which is so far from being true that, when I could not get fresh tar, I used the second water without difficulty, by means whereof it pleased God to recover from the small-pox two children in my own family, who drank it very copiously, a sufficient proof that it is not of that fiery caustic nature which some would persuade us.

The truth is, my sole reason for advising the tar not to be used a second time was, because I did not think it would sufficiently impregnate the water, or render it strong enough, after so much of the fine volatile parts had been carried off by the former infusion. Truth obligeth me to affirm that there is no danger (for as much as I could ever observe) to be apprehended from tar-water, as commonly made; the fine volatile oil, on which I take its cordial quality to depend, is, in its own nature, so soft and gentle, and so tempered by the acid, and both so blended and diluted with so great a quantity of water, as to make a compound, cherishing and cordial, producing a genial kindly warmth without any inflaming heat, a thing I have often said, and still find it necessary to inculcate.

Some medicines indeed are so violent that the least excess is dangerous; these require an exactness in the dose, where a small error may produce a great mischief. But tar is, in truth, no such dangerous medicine, not even in substance; as I have more than once known it taken innocently, mixed with honey, for a speedy cure of a cold.

But, notwithstanding all that hath been said on that subject, it is still sometimes asked, What precise quantity or degree of strength is required? To which I answer (agreeably to what hath been formerly and frequently observed), The palate, the stomach, the particular case and constitution of the patient, the very climate or season of the year, will dispose and require him to drink more or

less in quantity, stronger or weaker in degree; precisely to measure its strength, by a scrupulous exactness, is by no means necessary. Every one may settle that matter for himself, with the same safety that malt is proportioned to water in making beer, and by the same rule, to wit, the palate.

Only in general thus much may be said, that the proportions I formerly recommended will be found agreeable to most stomachs, and withal of sufficient strength, as many thousands have found, and daily find, by experience. —I take this opportunity to observe, that I use tar-water made in stone ware or earthen very well glazed, earthen vessels unglazed being apt to communicate a nauseous sweetness to the water.

Tar-water is a diet-drink, in the making whereof there is great latitude, its perfection not consisting in a point, but varying with the constitution and palate of the patient, being, nevertheless, at times, taken by the same person, weaker or stronger, with much the same effect, provided it be proportionably in greater or lesser quantity. It may indeed be so very weak as to have little or no effect; and, on the other hand, so very strong as to offend the stomach; but its degree of strength is easily discerned by the colour, smell, and taste, which alone are the natural and proper guides whereby to judge thereof: which strength may be easily varied, in any proportion, by changing the quantity either of tar or water, or the time of stirring. As for setting tar-water to stand, this is not to make it stronger, but more clear and palatable.

I found myself obliged to assert the innocence and safety, as well as usefulness, of the tar-water, as it is commonly made by the methods laid down in my former writings on this subject; and this not only in regard to truth, but much more in charity to a multitude, which may otherwise perhaps be influenced by the authority of some who endeavour to put them out of conceit with a medicine so cheap, so efficacious, and so universal, by suggesting and propagating scruples about a caustic quality arising from the volatile oily particles of tar, or resin imbibed together with the acid in making tar-water; an apprehension so vain that the reverse thereof is true, for which I appeal to the experience of many thousands, who can answer for

the innocence and safety, as well as efficacy, of this medicine, of which there are such ample and numerous certificates published to the world.

I shall finish my essay on the Plague and its Cure with observing that, in case God should withhold His hand for the present, yet these reflexions will not be altogether fruitless, if they dispose men to a proper temper of mind, and a cautious regimen, avoiding all extremes (which things are justly reckoned among the chief preservatives against infection); but especially if the apprehension of this destroyer shall beget serious thoughts on the frailty of human life, and, in consequence thereof, a reformation of manners; advantages that would sufficiently repay the trouble of writing and reading this Letter, even though the trial of tar-water, as a remedy for the Plague, should be postponed (as God grant it may) to some future and distant opportunity.

A LETTER

BY THE AUTHOR OF *SIRIS*

TO THE REVEREND DR. HALES,

ON THE

BENEFIT OF TAR-WATER IN FEVERS,

FOR CATTLE AS WELL AS THE HUMAN SPECIES[1]

To one gallon of fresh tar, pour six gallons of cold water; stir and work them strongly together, with a large flat stick, for the space of one full hour; let the whole stand six or eight hours, that the tar may subside; then scum it, and pour off the water, whereof three gallons warm are to be given the first day, two the second, and one the third day, at equal intervals, the dose not being less than a pint, nor more than a quart; and the beast being all that time, and for two or three days after, kept warm and nourished, if it will not eat hay, with mash or gruel.

[1] This *Letter* was published in 1747, 'at his Lordship's desire, on occasion of the present distemper among the Cattle, and for the general good of mankind.' It is omitted in all the editions of Berkeley's Works prior to 1871. A protracted epidemic of cattle-distemper was raging in Ireland when it was written.

The Rev. Dr. Stephen Hales (1677–1761) published *An Account of some Experiments and Observations on Tar-water: wherein is shown the quantity of Tar that is therein* (read before the Royal Society), which appeared early in 1745, followed by a second edition in 1747. With Boyle, Newton, and Halley, he was a frequent contributor to the *Philosophical Transactions*. His work on *Vegetable Staticks* (1727) helped to lay the foundation of Vegetable Physiology. He died at Teddington, in Middlesex, of which parish he was rector. Cf. *Siris*, sect. 196.

I believe this course will rarely fail of success, having often observed fevers in human kind to have been cured by a similar method. But, as in fevers it often throws out pustules or ulcers on the surface of the body, so in beasts it may be presumed to do the like; which ulcers, being anointed with a little tar, will, I doubt not, in a short time, dry up and disappear.

By this means the lives of infected cattle may be preserved at the expense of a gallon of tar for each. A thing which I repeat and inculcate, not only for the sake of the cattle and their owners, but also for the benefit of mankind in general, with regard to a fever; which terrible subduer and destroyer of our species, I have constantly found to be itself easily subdued by tar-water. Nevertheless, though in most other cases I find that the use of this medicine hath generally obtained, yet in this most dangerous and frequent case, where its aid is most wanted, and at the same time most sure, I do not find that the use thereof has equally obtained abroad in the world.

It grieves me to think that so many thousands of our species should daily perish, by a distemper which may be easily cured by a remedy so ready at hand, so easy to take, and so cheap to purchase, as Tar-water, which I never knew to fail when copiously drank in any sort of fever. All this I say after more than a hundred trials, in my own family and neighbourhood.

But, whatever backwardness people may have to try experiments on themselves or their friends, yet it is hoped they may venture to try them on their Cattle, and that the success of such trials in fevers of brutes (for a fever it plainly is) may dispose them to probable hopes of the same success in their own species.

Experiments, I grant, ought to be made with caution, and yet they may be made, and actually are made every day on probable reasons and analogy. Thus, for instance, because I knew that tar-water was cordial and diaphoretic, and yet no inflamer, I ventured to give it in every stage of the small-pox, though I had never heard of its being given otherwise than as a preservative against that distemper; and the success answered my expectation.

If I can but introduce the general use of tar-water for this murrain, which is in truth a fever, I flatter myself

this may pave the way for its general use in all fevers whatever.

A murrain among cattle hath been sometimes observed to be the forerunner of the Plague among men. If that should prove the present case (which God forbid) I would earnestly recommend the copious drinking of warm tar-water, from the very first appearance of the symptoms of such plague. I do also recommend it to be tried in like manner against the bite of a mad dog, when other approved remedies are not at hand.

FARTHER THOUGHTS

ON

TAR-WATER

First published in 1752

FARTHER THOUGHTS

ON TAR-WATER [1]

As the many experiments that are daily made of the virtues of Tar-water furnish new discoveries and reflexions, some of these I have thrown together, and offer to the public in hopes they may prove useful.

It is a frequent complaint that tar-water is made of bad tar, being of a reddish colour, sweetish, or disagreeably insipid. But, though the dregs of tar are often foul, and make foul tar-water, and though the tar already used is often made use of by unfair dealers a second, if not a third time, which produceth a vile potion, void of the genuine flavour and virtue of tar-water; yet I apprehend these defects may sometimes be ascribed rather to the vessel wherein the tar-water is made than to the tar itself.

Tar-water being made in an earthen vessel unglazed, or that hath lost part of its glazing, may extract (as it is a strong menstruum) from the clay a fade sweetishness, offensive to the palate. It should seem, therefore, that the best way of making tar-water is in a stone jug, or earthen vessel, throughout well glazed; and, as it will not fail to extract a tincture from any metallic vessel, it should be warmed in a well-glazed pipkin, rather than a saucepan.

By increasing the proportion of tar to the water, and by

[1] Berkeley's literary life closes with this tract, which appeared in his *Miscellany*, in October, 1752, about three months before his sudden death at Oxford. It seems to have been written at Cloyne, and in the early part of that year, for he removed to Oxford in July.

stirring it longer, tar-water may be made strong enough for a spoonful to impregnate a large glass, a thing very useful on a road.

Those who in chronical disorders, or as a preservative, have for a long time drank tar-water, must in acute cases drink the more.

Tar-water must be drank warm in agues, small-pox, measles, and fevers, in cholic, and disorders of the bowels, in gout also, and rheumatism; in most other ailments cold or warm, at the choice of the patient.

In fevers the patient cannot begin too soon, or drink too much. By undoubted experience it is found to cool the hot, and warm the cold, and to be a most successful medicine in fevers, notwithstanding its great virtue in palsies and dropsies.

When not long since an inflammation attacked the throat, breast, and lungs of children, and became general in my neighbourhood, numbers were recovered by the use of tar-water; nor did I hear that any miscarried who used it, though many perished who did not.

Nor is it a medicine less proper and efficacious in old age. At the same time that this inflammatory distemper raged among the children, a woman in her sixty-eighth year, from violent cold, was seized at once with ague, colic, and jaundice, of all which maladies she was cured in a fortnight, by drinking three pints of warm tar-water every day. Numberless such instances daily occur, which shew it to be a safe and efficacious medicine for old and young.

Evacuations by sweat, which usually render patients very weak and dispirited, have not the same bad effects when produced by tar-water, which I have frequently known to give high spirits in all the stages of a fever, and under the lowest regimen; therefore old people and weak persons, who cannot well bear common evacuations, are best cured by tar-water, which in some sort seemeth to renew those who are worn out with age and infirmities.

Tar-water is of singular use in strengthening the stomach and bowels, and agrees particularly well with infants, taken either by themselves or by the nurse, and best by both. Though, as it throws the ill humours out into the surface of the skin, it may render them for a time, perhaps, unseemly with eruptions, but withal healthy and lively. And

I will venture to say that it lays in them the principles of good constitution for the rest of their lives.

Nor is it only useful to the bodies of infants; it hath also a good effect on their minds, as those who drink it are observed to be remarkably forward and sprightly. Even the most heavy, lumpish, and unpromising infants appear to be much improved by it. A child there is in my neighbourhood, of fine parts, who at first seemed stupid and an idiot, but, by constant use of tar-water, grew lively and observing, and is now noted for understanding beyond others of the same age.

Infants are easily brought to take it by spoon, and even grow to a liking of it; and, as their disorders arise chiefly from indigestion, they receive the greatest benefit from a medicine so well calculated to strengthen the intestines, and preserve them from fits. In a word, if it were the common practice to accustom infants from the beginning to take tar-water, this would greatly conduce to the health both of their minds and bodies. There is, I am verily persuaded, no one thing in the power of art or nature that would so generally and effectually contribute to repair the constitutions of our gentry and nobility, by strengthening the children, and casting off in their infancy those impurities and taints which they often bring into the world.

An infant may take one quarter of a pint in the day, warm, by spoonfuls; less may do good, and there is no fear of excess. When I consider the private woe of families, as well as the public loss occasioned by the death of such an incredible number of infants under two years of age, I cannot but insist on recommending tar-water, both as a remedy and preservative in that tender age, which cannot bear the common treatment and methods of physic, or with safety take those drugs which are fitter for grown persons.

Another reason which recommends tar-water, particularly to infants and children, is the great security it brings against the small-pox to those that drink it, who are observed, either never to take that distemper, or to have it in the gentlest manner.

There is no distemper more contagious and destructive than the small-pox, or more generally dreaded, attended with worse symptoms, or that leaves behind it worse

effects. I observe, at the same time, that tar-water is in no other case a more safe and sure remedy than in this; of which Captain Drape's certificate[1], sworn to before the Mayor of Liverpool, in the presence of several principal persons of that town, is a most evident proof.

That one hundred and seventy persons, seized at once with the small-pox, deprived of all conveniences, and in the worst circumstances in a narrow ship and hot climate, should all recover by the single medicine of tar-water, except one who would not drink it, is a matter of fact so plain and convincing, and so well attested, as to leave no doubt, in minds free from prepossession, about the usefulness and efficacy of tar-water in the small-pox, a point I had been before sufficiently convinced of, by many instances in my own neighbourhood.

It hath been surmised by some celebrated physicians[2] that one day a specific may be discovered for the peculiar venom of the small-pox. There seems to be some reason for thinking that tar-water is such a specific. I say this on good grounds, having by many experiments observed its virtue in curing, as well as in preventing, that cruel distemper; during the whole course of which, it is to be drank warm; a moderate glass (about half a pint) every hour, in common cases, may suffice; in bad cases more may be given; there is no fear of excess.

Those who endeavour to discredit this cooling, cordial, and salutary medicine, as an inflamer of the blood, do very consistently decry its use in the small-pox; but there can be nothing more clear, full, and satisfactory than Captain Drape's affidavit, to convince reasonable people of the great and surprising efficacy of tar-water in the cure of the small-pox; and consequently of the groundlessness of that report which ascribes a heating or inflaming quality to it. And yet that groundless report hath hindered many from reaping the benefit they might otherwise have done

[1] Cf. *Second Letter to Thomas Prior, Esq.*, sect. 18. Berkeley was blamed by his critics for overlooking negative instances, which it was alleged might be found by more rigid scrutiny.

[2] Boerhaave, for instance. Cf. *Siris*, sect. 83. Berkeley was writing nearly half a century before the promulgation of Jenner's great discovery, which has conferred benefits upon the human race only second to those which he prognosticated from tar-water.

from the use of this water, which is of excellent virtue in all kinds of inflammatory disorders, fevers, quinsies, pleurisies, and suchlike, of the hot and inflamed kind, whereof the public as well as myself have known a multitude of examples.

I ask whether the fact sworn before the magistrates of Liverpool be not a sufficient answer to all that is objected, from an inflaming quality, to tar-water? Can any instance be produced in the whole materia medica, or history of physic, of the virtue of a medicine tried on greater numbers, or under greater disadvantages, or with greater success, or more credibly attested? I wish, for the common good of mankind, that the same experiment was tried in our hospitals. Probably the world would soon be relieved from that great and general terror of the small-pox.

When I hear of the devastations made by this distemper in great cities and populous towns, how many lives are lost, or as may be said thrown away, which might have been in all likelihood easily preserved, by the use of a medicine so cheap and obvious, and in every one's power, it seems matter of great concern and astonishment, and leaves one at a loss to guess at the motives that govern human actions in affairs of the greatest moment. The experiment may be easily made if an equal number of poor patients in the small-pox were put into two hospitals at the same time of the year, and provided with the same necessaries of diet and lodging; and, for farther care, let the one have a tub of tar-water and an old woman; the other hospital, what attendance and drugs you please.

In all obstinate sores and ulcers, I very much recommend the drinking of tar-water; and washing them with a strong lotion of it will hasten the cure.

One of the most painful and dangerous cases is that of a woman's sore breast. How many poor creatures, after long languishing in misery, are obliged to suffer the most severe chirurgical operations, often the cutting off the entire breast? The use of tar-water in those cases hath been attended with such success that I do earnestly recommend the drinking thereof, both as a cure and preservative, as a most effectual medicine to remove the shooting pains that precede a cancer, and also to cure

the cancer itself, without amputation. Cancerous and sore breasts are such cruel cases, occasioned by so many internal causes, as well as outward accidents, that it is a necessary piece of humanity, to contribute all we can to the prevention and cure thereof.

In the king's evil, leprosy, and foulest cases, tar-water cannot be too much recommended. The poor vagabonds of Ireland are many of them infected and eaten up with the foul disease, which with them passeth for a canker as they call it. Several instances of extraordinary cures have been performed on such persons, by drinking tar-water copiously, for some weeks or months together, without confinement or other restraint than that of a regular cool diet. It is indeed a specific both for this and all other taints and impurities of the blood.

An extract of *Siris* was made, and accounts of the effects of tar-water were reprinted in America[1], in which continent, as well as in the islands, much use hath been made thereof, particularly by those who possess great numbers of slaves. Of this I have been informed by letters, and by word of mouth, from persons belonging to those parts, who have assured me of the extensive and successful use of this medicine in many cases, and more especially in the most inveterate kinds of the foul disease.

I need not say how dearly they purchase health who obtain it by salivation, and yet, long and severe as that course is, it is often unsuccessful. There are instances of such as having passed through it with much misery and patience have been afterwards cured by the simple use of tar-water.

The king's evil, so loathsome in its symptoms and effects, and withal so difficult if at all possible to cure

[1] In a letter to his American friend, Dr. Samuel Johnson, dated 'Cloyne, August 23, 1749,' Berkeley refers to 'a small pamphlet relating to tar-water' which Johnson had sent to him. He adds, 'I can only say, in behalf of those points in which the ingenious author seems to differ from me, that I advance nothing which is not grounded on experience, as may be seen at large in Mr. Prior's *Narrative of the Effects of Tar-water*, printed three or four years ago, and which may be supposed to have reached America.' He again refers to this American pamphlet, in a letter to Mr. Archdall, in November, 1751. See my *Life and Letters of Berkeley*, pp. 297–301, 320, 329. Prior died in 1751.

by any other method, is most surely and easily cured by the tar-water, even when the patient is far gone, even when he derives it from his ancestors. A quart *per diem* for a few months, I have known to cure the most deplorable and abandoned cases.

How many wealthy families, otherwise at their ease, are corrupted with this taint in their blood! How many want heirs and husbands through this odious malady! A specific for this disease alone would be justly esteemed a most valuable secret, and the plenty and cheapness of the medicine ought not in reason to make it less esteemed.

Salivating, bleeding, and purging are attended with great hardships and inconveniences even where the patient recovers, reducing the strength and spirits of those who use them, whereas tar-water greatly adds to both.

In fractures and wounds, a quart or two drank daily while the patient is under cure doth very much assuage the pain and promote his recovery, both as by its balsamic nature it disposeth the parts to heal, and also as it lessens, if not totally prevents, the fever.

A poor boy in Cloyne, having fallen from a tree, broke both arm and wrist. This accident was concealed or neglected for two or three weeks; he was then put under the care of a skilful bone-setter, who, finding the bones knit and grown crooked, and that it would be necessary to break them again, in order to set them right, and withal considering the hot season of the year (in July), he apprehended his patient's being thrown into a fever that might prove fatal. But the boy being made to drink copiously of tar-water, this prevented or lessened the fever in such sort that the bones were broke and set again, and the cure proceeded as easily and speedily as could be wished.

I have known several instances of bruises and wounds cured by tar-water. A person in my neighbourhood ran over by a horse was much bruised, and cured only by drinking tar-water. Another knocked down with a mallet, thereupon thrown into a violent fever and given for dead; another wounded with an axe so that his life was thought in danger, were both recovered by the use of tar-water; which, as it is sovereign against gangrenes and fevers, hath great success in all sorts of wounds, contusions, and fractures, being taken throughout the whole chirurgical

process, along with whatsoever other methods or remedies are applied.

Tar-water operates variously. In dropsies and bruises it hath been known to work by purging. The stronger kind being used as a wash is good against ulcerous eruptions. But, in all cases where the lotion is used, I believe the drinking of tar-water might alone suffice, albeit the sores may be longer withering and dying away.

There is a certain age or time of life when the female sex runs no small risk from the ceasing of their natural evacuations. In this case tar-water is a good preservative, purifying the blood, and clearing it from that cancerous tendency, which it is sometimes subject to about that time. I take it to be a specific in all cancerous cases, even the bleeding cancer, esteemed incurable by physicians, hath been cured by tar-water.

In diseases peculiar to women it is of no small use. Several who had suffered much by accidents in child-bearing have found themselves relieved by tar-water. In all sorts of tumours, wens, and preternatural excrescences, it hath been found an excellent remedy.

Many dangerous symptoms, and even sudden death, are often owing to a polypus, in some or other of the vessels through which the blood circulates, than which it seems there is no inward cause of death or disease more to be dreaded and guarded against. How many drop down dead in our streets, or at table, or in the midst of business, or diversions? How many are found dead in their beds?

Tremors, palpitations of the heart, irregular pulses, apoplexies, sudden deaths, often proceed from a slow, stagnating, interrupted motion, or stoppage of the blood in its circulation through the body; and there seemeth to be no cause so certainly productive of obstructed circulation as the polypus, a case, perhaps, much more frequent than is commonly imagined. Morgagni[1], the celebrated professor at Padua, and most eminent anatomist, who was supposed to have dissected more human bodies than any man living, assured me, above thirty years ago, that in the

[1] An Italian anatomist of repute, for many years Professor of Anatomy at Padua, who died in 1771, in his ninetieth year. Berkeley seems to have met him in the course of his last visit to Italy, more than thirty years before this tract was written.

far greater part of such bodies, he found polypuses, if not in the ventricles of the heart or larger vessels, yet in some other vessel or cavity; to which he attributes many disorders, and which he supposed to be formed by the obstructed motion of the blood. To prevent this, he dissuaded from all tight ligatures, especially in sleep, unbuttoning the neck and wristbands of his shirt every night, a practice he had learned (as he said) from his master the famous Malpighi[1].

When the circulation is once quite stopped nothing can restore it, which would be the same thing as restoring a dead man to life; and in proportion as the circulation of the blood is obstructed, the body is disordered. Total obstruction is death; partial obstruction is disease. The polypus therefore is always hurtful, if not mortal. It is, indeed, matter of serious reflexion, that we may probably carry about with us a principle of death, always at work within, and of a nature so violent and sudden in its effects, so hard to come at, and so difficult to subdue.

It may well be thought, at first view, a vain undertaking, to attempt to dissolve a fleshy or membranous substance, so latent and inaccessible, by common means or medicines. But, as tar-water hath been undoubtedly known to dissolve and disperse wens, and other fleshy or membranous tumours, in the outward parts of the body[2], having been drank and circulated with the blood, it should seem, by a parity of reason, that it may also dissolve and put an end to those concretions that are formed in the ventricles of the heart or blood vessels, and so remove one great cause of apoplexies and sudden death: and what cures may prevent. I have been the longer on this subject, for the sake of many who lead sickly lives, as well as several who are snatched away by untimely death.

Universally, in all cases where other methods fail, I could wish this of tar-water was tried. It hath been sometimes known that the most inveterate head-aches, and other nervous disorders, that would yield to no other

[1] One of the most famous anatomists and botanists of the seventeenth century, Professor of Medicine successively in the universities of Pisa, Messina, and Bologna. He died at Rome in 1694.

[2] [See *The Effects of Tar-water*, sect. 228, 229.]—AUTHOR. Prior's tract is here referred to.

medicine, have been cured by a course of tar-water regularly and constantly pursued.

Wheresoever pure blood or plenty of spirits are wanting, it may be concluded from manifold experience that tar-water is of singular benefit. Several persons have acknowledged themselves to be much fitter to go through business or study from the use of it.

Nor is it only medicinal to human kind: it is also of no small use in the curing of brute animals. It hath been tried on several kinds, particularly with great success in the late epidemical distemper of our horses. And I have been credibly informed that, being drank in plenty, it hath recovered even a glandered horse that was thought incurable.

And, as it is of such extensive use both to man and beast, it should seem that a tub of tar-water constantly supplied in a market town, would serve, in some sort, for an hospital. Many other drugs are not easily got, this is everywhere plenty and cheap; many are of a doubtful nature, this of known innocence; others soon perish, this lasts for years, and it is not the worse for keeping. This, in short, is a medicine for the common people, being a safe and cheap remedy for such as cannot afford to be long sick, or to make use of costly medicines.

A patient who drinks tar-water must not be alarmed at pustules or eruptions in the skin; these are good symptoms, and shew the impurities of the blood to be cast out. It is also not amiss to observe that, as tar-water, by its active qualities, doth stir the humours, entering the minutest capillaries, and dislodging obstructions, it may happen that this working shall sometimes be felt in the limbs, or discharge itself in a fit of the gout, which, however disagreeable, proves salutary.

I am credibly informed of several strange conveyances, which tar-water hath found out, whereby to discharge impurities from the human constitution. A person who had been in a bad state of health above twenty years, upon a course of tar-water was thrown into a most extraordinary fit of an ague, and from that time recovered a good state of health. An old gentleman in the county of Cork, who, for a long time, had been a valetudinarian, afflicted with many infirmities, being advised to drink tar-water, found

himself relieved; but it produced and soon cured a pthiriasis or lousy distemper, in which the putrid humours having discharged themselves left him quite sound and healthy.

In a course of tar-water, if any disorder happens from some other cause, as from cold, from the use of strong liquors, from a surfeit, or suchlike accident, it would not be fair to impute it to tar-water: and yet this hath been sometimes done.

The effects of vomiting occasioned by tar-water are not to be apprehended. Some are discouraged from drinking because their stomachs cannot bear it. But, when it takes a turn towards working upwards, nature, by that very way, hath been often known to carry on the cure. A worthy gentleman, member of Parliament, came into my neighbourhood in the autumn of the year 1750: he was cachetic and extremely reduced, so that his friends thought him near his end. Upon his entering into a course of tar-water, it produced a prodigious vomiting, which weakened him much for the present; but, persisting to continue the use thereof for about two months, he was restored to his health, strength, and spirits.

Tar-water is very diuretic, thereby preventing stone and gravel, and carrying off by urine those salts that might otherwise occasion fevers, rheumatisms, dropsies, headaches, and many other disorders, if retained in the blood. Hence some have apprehended a diabetes, from the continued use thereof, but it is so far from causing a diabetes that it hath been known to cure that disorder.

The constitution of a patient sometimes requireth, during a course of tar-water, that he take water and honey, also roasted apples, stewed prunes, and other diet of an opening kind. A hint of this is sufficient. If the reader now and then meets with some remarks contained in my former writings on this subject, he may be pleased to consider I had rather repeat than forget what I think useful to be known.

Some, endeavouring to discourage the use of tar-water in England, have given out that it may indeed be serviceable in Ireland, where people live on such low diet as sour milk and potatoes, but it cannot be of the same service in England, where men are accustomed to a more

liberal and hearty food; and indeed it must be owned that the peasants in this island live but poorly, but no people in Europe live better (in the sense of eating and drinking) than our gentry and citizens; and from these the instances of cures by tar-water have been chiefly taken. Those who would confine its use to the moist air and poor diet of Ireland may be assured that all over Europe, in France, and Germany, Italy, Portugal, and Holland, tar-water works the same effects. In both North and South, in West and East Indies, it hath been used and continues to be used with great success. It hath reached all our Colonies both on the Continent and the Islands, and many barrels of tar-water have been sent from Amsterdam to Batavia; of all which I have had authentic accounts. But its use is nowhere more conspicuous than at sea, in curing that plague of seafaring persons, the scurvy, as was found in the late attempt to discover a north-west passage; and (as I doubt not) will be found as oft as it is tried. Every ship in his Majesty's navy should always have a vessel of tar-water upon deck, for the use of the sailors, both in the scurvy and other maladies.

It is indeed a medicine equally calculated for all climates, for sea and land, for rich and poor, high and low livers; being, as hath been elsewhere mentioned, a cordial which doth not heat; a peculiar privilege this, and of excellent use. That it is a cordial is manifest from its cheering and enlivening quality; and that it is not heating is as manifest, from its singular use in all cases where the blood is inflamed. As this medicine imparts a friendly genial warmth, suited to the human constitution, those who pass through a course of tar-water would do well not to increase such friendly warmth to an inflaming heat, by a wrong regimen of high-seasoned food and strong liquors, which are not wanted by the drinkers of tar-water. There is a certain degree of heat necessary to the well-being and life of man. More than this will be uneasy, and this uneasiness indicates a proper choice of diet.

I have myself drank above a gallon of tar-water in a few hours, and been cooled and recovered from a fever by it. So many instances of the same nature I have known as would make it evident, to any unprejudiced

person, that tar-water is a cooling medicine; of which truth I am as thoroughly convinced as it is possible to be of any theorem in physic or natural science.

The unsuccessfulness of other methods should rather be an encouragement than a bar to the trial of tar-water. A young lady, daughter to a worthy gentleman near Cork, had been long afflicted with a grievous pain in her side, and, having had the best advice that could be got, was not relieved until she drank tar-water, which quite removed her pain. Some time after she was again seized with the same disorder, but, returning to the use of tar-water, she grew well, and still continues so.

A woman turned out of the infirmary at Cork as incurable, because she would not submit to the cutting off her leg, came to Cloyne, where she continued half a year drinking tar-water, and living upon bread and milk, by which course she recovered and went to service.

There is at present, while I am writing, a most remarkable case here at Cloyne, of a poor soldier in a dropsy, whose belly was swollen to a most immoderate size. He said he had been five months in an hospital at Dublin, and, having tried other methods in vain, left it, to avoid being tapped. It is a fortnight since he came to Cloyne, during which time he hath drank two quarts of tar-water every day. His belly is now quite reduced: his appetite and sleep which were gone are restored: he gathers strength every moment: and he who was despaired of seems to be quite out of danger, both to himself, and to all who see him. It is remarkable that, upon drinking the tar-water, he voided several worms of a very extraordinary size. This medicine, which is observed to make some persons costive, is to hydropic patients a strong purge. The present is but one of several instances wherein the dropsy hath been cured by tar-water; which I never knew to fail in any species of that malady.

I am very credibly informed that an aged clergyman of Maidstone in Kent, being reduced to the last extremity by the gout in his stomach, after having tried strong liquors and the methods usual in that case without success, betook himself to drink a vast quantity of warm tar-water, still replenishing and letting it take its course; by which it pleased God to deliver him from the jaws of death.

A gentleman in the county of Clare, near Ennis, had a fever and pleurisy, and inflammation of the lungs; being at the last extremity, and given over by two physicians, he was advised to drink tar-water, which he did, eight quarts. Next morning one of the doctors asking at what hour his patient died? to his great surprise found he was recovered. This I had from a parliament man, his neighbour.

When the yellow fever (as it was called) raged in the West Indies, the negroes, with a tub of tar-water in their quarters, did well: but some of the better sort miscarried, among whom the physician himself lay at the point of death; his brother recovered him by pouring down his throat in spoonfuls some of the same liquor that recovered the negroes. The fact was related to me by a gentleman who was then in the island of St. Christopher's, and knew it to be true.

A physician himself not long since assured me he had cured an ulcer in the bladder, by ordering his patient to drink tar-water, when he had tried all other methods in vain, and thought the case incurable.

But it would be endless to relate the effects of tar-water in desperate cases. The recovery of Mrs. Wilson, daughter of the late Bishop of London, from a lingering hopeless disorder, was a noted case, and attested to by his Lordship. I have even been informed, upon good authority, of two or three instances wherein persons have been recovered by tar-water after they had rattles in the throat.

In certain cases, a smaller quantity of tar-water hath proved ineffectual, when a larger hath perfected the cure. A woman of Cloyne got cold after child bearing, which occasioned a great pain in her thigh, swelling also and redness; she continued in great torment above three weeks. She then began to drink tar-water, but not drinking much she did not perceive much good; and when there was not any hopes of her life, she was persuaded to try what a gallon a day might do; upon this she grew better, the swelling broke and ran; no dressing was used but tar, and no washing but tar-water, until she was quite recovered.

In ailments of an odd and untried nature, it may be

worth while to try tar-water. In proof of this many instances might be given. A gentleman with a withered arm had it restored by drinking tar-water. Another who, by running his head against a post, had a concussion of the brain attended with very bad symptoms, recovered by drinking tar-water after other medicines had failed. In my own neighbourhood, one had lost the use of his limbs by poison, another had been bitten by a mad ass; these persons drank tar-water, and their cure was attributed to it.

When tar-water is copiously drank in fevers, the great danger to be guarded against is an excessive flow of spirits, which excites the patient to talk and divert himself with company, which may produce a relapse; of this I have known fatal effects.

If in a course of tar-water the patient should find himself heated, let him abstain from or lessen his dose of spirituous and fermented liquors; for tar-water alone never heats.

In chronical disorders it is not advisable to break off a course of tar-water at once, but rather to diminish the quantity by degrees.

The acid alone hath not the medicinal virtues of tar-water. This is agreeable to reason and experience, as well as the opinion of the ablest judges. Doctor Linden [1] justly observes, 'that when the empyreumatic oil is entirely separated from the acid, it is not in any shape superior to any other distilled acids or vinegars whatsoever.' (*Treatise on Selter Water*, p. 307.)

That extraordinary virtues should be contained in tar-water will not seem strange, if we consider that pitch is nothing else but hardened tar, or tar drained of its moisture; and that an extraordinary quantity of light [2]

[1] Diederick Wessel Linden, M.D., a German physician, settled in England, an authority in his day on mineral waters. The work referred to, which appeared in 1752, is entitled *A Treatise on the Origin, Nature, and Virtues of Chalybeat Waters and Natural Hot Baths. To which is added an Appendix on the Selter Water.* In the Appendix the author refers with approbation to the medical use of tar-water, which he proposes to mix with Selter water in certain cases; and he objects to a suggestion that the acid should be separated from the oil.

[2] Cf. *Siris*, sect. 152–162, on 'light' or 'fire,' 'which operates in everything.'

is retained in the substance of pitch, as appears from certain electrical experiments; which, having been made since, seem not a little to confirm what had before been suggested in *Siris*[1].

[1] [Something of this nature hath been long expected and hoped for, if we may credit that learned chemist Doctor Linden. 'At last (saith he) the long delayed wishes of the most eminent men of the faculty are fulfilled in the Bishop of Cloyne's discovery.' See *Treatise on Selter Water*, p. 303. Again (speaking of empyreumatic oils of plants) he hath these words—'There has always prevailed a notion among the chemists, and particularly with Paracelsus and his followers, that in those oils there lay a great secret undiscovered. This notion was occasioned by the strange effects which a small quantity thereof hath upon the human machine. Several have been very diligent to discover this secret, and to find out a method to administer these oils with safety. Yet nothing was performed salutary on this inquiry, until the Bishop of Cloyne discovered to us the tar-water; to him alone we are indebted for rendering the empyreumatic oils a safe medicine in every respect.' *Ibid.* p. 302.]—AUTHOR.

APPENDIX

A

BERKELEY'S ROUGH DRAFT OF THE INTRODUCTION TO THE PRINCIPLES OF HUMAN KNOWLEDGE

[I FOUND Berkeley's autograph of this rough draft of the 'Introduction' to his book of *Principles* in the manuscript department of the Library of Trinity College, Dublin. It seems to have been written in November and December, 1708. As this Introduction forms Berkeley's vindication for making his starting-point within the concrete universe of reality, instead of among empty abstractions, it may be well to have so important a part of his teaching in the form which it assumed when it was first struggling into expression. In this early attack upon 'abstract ideas,' his characteristic ardour seems to carry him to the extreme of rejecting universalising principles—modified in his later life, as appears in *Siris*. But he everywhere wants to lean on living and realising Mind, not on empty verbal formulas.]

INTRODUCTION.

Philosophy being nothing else but the study of wisdom and truth, it may seem strange that they who have spent much time and pains in it, do usually find themselves embarrass'd with more doubts and difficulties than they were before they [[1] came to that study. There is nothing these men can [[2] touch] with their hands or behold with their eyes but has its inaccessible and dark sides. Something] they imagine to be in every drop of water, every grain of sand which can puzzle [[3] and confound] the most clear and [[4] elevated] understanding, and are often by

[1] On the opposite page of the MS., instead of what follows within brackets—'meddled with that study. To them the most common and familiar things appear intricate and perplex'd, there's nothing but has its dark sides. Somewhat'

[2] 'handle.'

[3] Erased.

[4] 'comprehensive.'

their principles led into a necessity of admitting the most irreconcilable opinions for true, or (which is worse) of sitting down in a forlorn scepticism.

The cause of this is thought to be the obscurity of things, together with the natural weakness and imperfection of our understanding. It is said the senses we have are few, and these design'd by nature only for the support of life, and not to penetrate into the constitution and inward essence of things. Besides, the mind of man being finite when it treats of things which partake of infinity, it is not to be wonder'd at if it run into absurdities[1] and contradictions, out of which it is [[2]absolutely] impossible it should ever extricate itself, it being of the nature of Infinite not to be comprehended by that which is finite[3].

But I cannot think our faculties are so weak and inadequate in respect of things, as these men would make us believe. I cannot be brought to suppose that right deductions from true principles should ever end[4] in consequences which cannot be maintain'd or made consistent. We should believe that God has dealt more bountifully with the sons of men than to give them a strong desire for that which he had placed quite out of their reach, and so made it impossible for them to obtain. Surely our wise and good Creatour would never have made us so eager in the search of truth meerly to baulk and perplex us, to make us blame our faculties, and bewail our inevitable ignorance. This were not agreeable to the wonted indulgent methods of Providence, which, whatever appetites it may have implanted in the creatures, doth usually furnish them with such means as, if rightly made use of, will not fail to satisfy them. Upon the whole my opinion is, that the far greatest part, if not all, of those difficultys which have hitherto amus'd philosophers, and block'd up the way to knowledge, are entirely owing to themselves. That they have first rais'd a dust, and then complain they cannot see.

My purpose therefore is, to [[5]try if I can] discover [[2]and point out] what those principles are which have introduc'd all that doubtfulness and uncertainty, those absurditys and contradictions into the several sects of philosophy, insomuch that the wisest men have thought our ignorance incurable, conceiving it to arise from the natural dulness and limitation of our faculties. And at the same time to establish such principles in their stead, as shall be free from the like consequences, and lead the mind into a clear view of truth. And surely it is a work well deserving of our pains, to try to extend the limits of our

[1] 'absurdities' instead of 'inconsistencys' erased.

[2] Erased.

[3] on the margin of this paragraph is written—'Nov. 15, 1708.'

[4] 'end' instead of 'terminate' erased.

[5] Instead of 'endeavour to.'

knowledge, and [1 do right to] human understanding, by making it to appear that those lets and difficultys which stay and embarrass the mind in its enquirys [2 after truth] do not spring from any darkness and intricacy in the objects, or [3 natural] defect in the intellectual powers, so much as from false principles which have been insisted on, and might have been avoided.

How difficult and discouraging soever this attempt may seem, when I consider what a number of men of very great and extraordinary abilitys have gone before me, [4 and miscarry'd] in the like [5 designs, yet] I am not without some hopes, upon the consideration that the largest views are not always the clearest, and that he who is shortsighted will be apt to draw the object nearer, and by a close and narrow survey may perhaps discern that which had escaped far better eyes.

[6 In my entrance upon this work] I think it necessary to take notice of [7 that wch seems to have been the source of a great many errours, and to have made the way to knowledge very intricate and perplex'd, that wch seems to have had a chiefe part in rendering speculation intricate and perplex'd, and to have been the source of innumerable errours and difficulties in almost all parts of knowledge]—and that is the opinion that there are Abstract Ideas or General Conceptions of Things. He who is not a perfect stranger to the writings and [8 notions] of philosophers must needs acknowledge that [9 no small] part of [10 them] are spent [11 about Abstract Ideas. These are, in a more special manner, thought to be the objects of those sciences that go by the name of logic and metaphysics, and of all that which passes under the notion of the most abstracted and sublime philosophy. In all which [4 speculative sciences] you shall scarce find any question handled [4 by the philosophers] in such a manner as does not suppose their existence in the mind, and that it is very well acquainted with them; [4 so that these parts of learning must of necessity be overrun

[1] Instead of 'beat down those mounds and barriers that have been put to.'

[2] Within brackets in the MS.

[3] Instead of 'incurable' erased.

[4] Erased.

[5] Instead of 'undertakings.'

[6] Instead of 'But here in the entrance, before I proceed any further.' On the blank page opposite we have—'In my entrance upon this work [before I descend to more particular subjects] [and] [to more particular enquirys].'

[7] Instead of—'y^{t} w^{h} seem to me [one] very powerful and universal cause of error and confusion throughout the philosophy of all sects and ages'—and the opposite page, 'that which seems to me a wide-spread [in philosophical enquirys] throughout the philosophy of all sects and ages.'

[8] Brackets in the MS.

[9] Instead of 'very great.'

[10] Instead of 'their disputes and contemplations [speculations].'

[11] 'concerning' instead of 'about' erased.

with [very much] useles wrangling and jargon, [innumerable] absurdities and contradictions [opinions], if so be that Abstract General Ideas are perfectly inconceivable, as I am well assur'd they [never were—cannot be] conceived by me, [1 nor do I think it possible they should be conceiv'd by any one else].]

By abstract idea, genera, species, universal notions, all which amount to the same thing, as I find these terms explain'd by the best and clearest writers, we are to understand ideas which equally represent the particulars of any sort, and are made by the mind which, observing that the individuals of each kind agree in some things and differ in others, takes out and singles from the rest that which is common to all, making thereof one abstract general idea; which [2 general idea] contains all those ideas wherein the particulars of that kind agree [2 and partake], separated from and exclusive of all those other concomitant ideas whereby they [2 individuals] are distinguished [2 from each other] one from another. [2 To this abstract general idea thus framed the mind gives a general name, and lays it up and uses it as a standard whereby to judge what particulars are and what are not to be accounted of that sort, those onely which contain every part of the general idea having a right to be admitted into that sort and called by that name.]

For example, the mind having observed that Peter, James, and John, &c. resemble each other in certain common agreements of shape and other quality, leaves out of the complex idea it has of Peter, James, &c. that which is peculiar to each, retaining onely that which is common to all. And so it makes one [3 abstract] complex idea, wherein all the particulars partake, abstracting entirely from and cutting off all those circumstances and differences which might determine it to any particular existence: and after this manner you come by [4 the] precise abstract idea of [2 a] man. In which [2 idea] it is true there is included colour, because there is no man but hath some colour, but then it can be neither white [2 colour] nor black [2 colour] nor any particular colour, but colour in general, because there is no one particular colour wherein all men partake. In like manner you will tell me there is included stature, but it is neither tall stature nor low stature, nor yet middling stature, but stature in general. And so of the rest. [5 Suppose now I should ask whether you comprehended, in this your abstract idea of man, the ideas of eyes, or ears, or

[1] On opposite page—'and I very much question whether they ever were or can be by any one else.'

[2] Erased.

[3] Instead of 'general.'

[4] Instead of 'a clear.'

[5] Erased. On opposite page, but erased, are the words—'an odd and mutilated idea, that of man without all these.' And on the same page—'it must needs [make an odd and frightful figure the idea] of [a] man without all these,' also erased.

nose, or legs, or arms, [this might perhaps put you to a stand for an answer, for] you will own it to be an odd and mutilated idea of a man wch is without all these. Yet it must be so to make it consistent with the doctrine of abstract ideas, there being particular men that want, some arms, some legs, [some] noses, &c.]

[[1] But supposing the abstract idea of man to be very conceivable, let us proceed to see [[2] how] it comes to be enlarg'd into the more general and comprehensive idea of animal.] There being a great variety of other creatures [[1] as birds] that partake in some parts, but not all, of the complex idea of man, the mind leaving out those parts which are peculiar to men, and retaining those onely which are common to all the living creatures, frames the idea of animal, [[1] which is more general than that of man, it comprehending not only all particular men, but also all birds, beasts, fishes, and insects.] The constituent parts whereof [[1] of the complex idea of animal] are body, life, sense, and spontaneous motion. By body is meant body [[1] in general], without any particular shape or figure, there being no one shape or figure common to all animals, without covering either of hair, or feathers, or [[3] scales], and yet it is not naked. Hair, feathers, [[3] scales], and nakedness being peculiar distinguishing properties of [[1] the] particular animals, and for that reason left out of the [[4] abstract] idea. Upon the same account, the spontaneous motion must be neither walking nor flying nor creeping, it is nevertheless a motion, but what that motion is it is not easy to say.

In like manner a man [[1] having seen several lines] by leaving out of his idea of a line [[5] the particular colour and length], comes by the idea of a line, which is neither black, nor white, nor red, &c., nor long nor short, which he calls the abstract idea of a line, and which, for ought that I can see, is just nothing. [[1] For I ask whether a line has any more than one particular colour and one particular length, which [when they are] being left out, I beseech any [6] one to consider what it is that remains.]

Whether others have this [[7] wonderful] faculty of abstracting their ideas, they can [[8] best] tell. For myself, I dare be confident I have it not; [[1] and I am apt to think that some of those who fancy themselves to enjoy that privilege, would, upon looking narrowly into their own thoughts, find they wanted it as much as I. For there was a time when, being banter'd and abus'd by words, I did not in the least doubt my having it. But

[1] Erased.
[2] Instead of 'by what steps and abstractions.'
[3] Instead of 'fins.'
[4] Instead of 'general.'
[5] Instead of 'all particular colour, and all particular length.'
[6] 'one' instead of 'man.'
[7] Instead of 'marvellous.'
[8] Instead of 'better.'

upon a strict survey of my abilitys, I not only discover my own deficiency in that point, but also cannot conceive it possible that such a person should be even in the most perfect and exalted understanding.] I find I have a faculty of imagining, conceiving, or representing to myself the ideas of those particular things I have perceiv'd, and of variously compounding and dividing them. I can imagine a man with two heads, or the upper parts of a man joyn'd to the body of a horse. I can consider the hand, the eye, the nose each by itself [[1] abstracted or] separated from the rest of the body. But then whatever eye or nose I imagine, they must have some particular shape and colour. The idea of man that I frame to myself must be either of a white, or a black, or a tawny, a straight or a crooked, a tall or a low or a middling sized man. I cannot by any effort of [[2] thought] frame to myself an idea of man [[3] prescinding from all particulars] that shall have nothing particular in it. [[3] For my life I cannot comprehend abstract ideas[4].]

And there are grounds to think [[5] most] men will acknowledge themselves to be in my case. The generality of men, which are simple and illiterate, never pretend to abstract notions. It is said they are difficult and not to be attained without much study and speculation, we may therefore reasonably conclude that, if such there be, they are altogether confin'd to the learned.

But it must be confess'd, I do not see what great advantage they give them above the rest of mankind. He who considers that whatever has any existence in nature and can any wise affect or concern [[3] is] him is particular, will not find great cause to be discontent with his facultys, if [[6] they] cannot reach a piece of knowledge as useless as it is refin'd; [[3] and] which whether it be to be found even in those deep thinkers may well be made a question.

For besides the [[7] incomprehensibleness] of abstract ideas to my understanding (which may pass for an argument, since those gentlemen do not pretend to any new facultys distinct from those of ordinary men), there are not wanting other proofs against them. [[8] It is, I think, a receiv'd axiom that an impossi-

[1] Instead of 'singled out and.'

[2] Instead of 'imagination.'

[3] Erased.

[4] On opposite page the words—'I can conceive well enough what is meant by adequate and inadequate, clear and obscure, distinct and confus'd [ideas], but'—are written and erased.

[5] Instead of 'the far greatest part of.'

[6] Instead of 'he.'

[7] Instead of 'incomprehensibility,' and on opposite page, but erased—'incomprehensibleness . . . to my understanding . . . . . by any [intellect—understanding] whatsoever.'

[8] Erased. On opposite page—'That a contradiction cannot be conceiv'd by any human understanding whatsoever is, I think, agreed on all hands. And to me it is no less clear that the description of an abstract idea doth include a contradiction in it.'

bility cannot be conceiv'd. For what created intelligence will pretend to conceive that which God cannot cause to be? Now it is on all hands agreed, that nothing abstract or general can be made really to exist; whence it should seem to follow, that it cannot have so much as an ideal existence in the understanding.]

[[1]I do not think it necessary to insist on any more proofs, against the doctrine of abstraction in this place, especially for that the absurditys, which in the progress of this work I shall observe to have sprung from that doctrine, will yield plenty of arguments a posteriori against it.] I proceed [[1]therefore] to examine what can be alledged in defence [[2]of the doctrine of abstraction], and try if I can discover what it is that [[3]inclines] the men of speculation to embrace an opinion so pregnant of absurditys, and so remote from common sense as that seems to be.

There has been a late excellent and deservedly esteem'd philosopher, to whose judgment, so far as authority is of any weight with me, I would pay the utmost deference. This great man, no doubt, has very much countenanc'd the doctrine of abstraction by seeming to think [[4]it] is that which puts the widest difference in point of understanding betwixt man and beast. Thus speaks he: 'The having of general ideas is that which puts a perfect distinction betwixt man and brutes, and is an excellency which the facultys of brutes do by no means attain unto. For it is evident we observe no footsteps in them of making use of general signs for [[5]making] universal ideas; from which we have reason to imagine that they have not the faculty of abstracting, or making general ideas, since they have no use of words or any other general signs.' And a little lower: 'Therefore I think we may suppose that 'tis in this that the species of brutes are discriminated from men, and 'tis that proper difference wherein they are wholly separated, and which at last widens to so wide a distance. For if they have any ideas at all and are not bare machines (as some would have them), we cannot deny them to have some reason. It seems as evident to me, that they do some of them in certain instances reason, as that they have sense, but it is only in particular ideas, just as they receiv'd them from their senses. They are the best of them tied up within those narrow bounds, and have not (as I think) the faculty to enlarge them by any kind of abstraction.' (*Essay on Human Understanding*, Book 2. chap. II. s. 10, 11.) I readily agree with this authour that the faculties of brutes can by no means attain to the making of abstract general ideas. But then if that inability to abstract be made the distinguishing

[1] Erased.
[2] Instead of 'thereof.'
[3] Instead of 'has inclined.'
[4] Instead of 'the having abstract ideas.'
[5] Within brackets in the MS.

property of that sort of animals, I fear a great many of those that now pass for men must be reckon'd into their number.

The reason which is here assign'd why we have no grounds to think that brutes have general ideas, is that we observe in them no use of words or any other general signs—which is built on this supposition—that the making use of words implys the having of general ideas, and that [[1]on the other hand] those who have general ideas fail not to make use of words, or other universal signs, [[2]whereby] to express [[2]and signify them]. [[2]That this is the] From which it must follow, that men who use language are able to abstract and generalise their ideas, but brutes [[3]that] use it not are destitute of that faculty. That this is the sense and arguing of the authour of the *Essay*, will farther appear, by his answering the question he in another place puts. Since all things that exist are only particulars, how come we by general terms? His answer is—'Words become general by being made the signs of general ideas.' (*Essay on Human Understanding*, b. 3. c. 3. s. 6.) From which assertion I must crave leave to dissent, being of opinion that a word becomes general by being [[4]the] made the sign, not of a general idea, but of many particular ideas. Sure I am, as to what concerns myself, when I say the word Socrates is a proper [[2]or particular] name, and the word man an appellative or general name, I mean no more than this, viz. that the one is peculiar and appropriated to one particular person, the other common to a great many particular persons, each [[5]of which] has an equall right in propriety of language to be called by the name man. [[2]This, I say, is the whole truth of the matter, and not that I make any incomprehensible abstract idea whereunto I annex the name man. That were to [make] my words stand for I know not what.]

That great man seems to think the necessary ends of language could not be attain'd [[2]to] without the use of abstract ideas. B. 3. c. 6. s. 39 [[2]he shews it] and elsewhere he shews it to be his opinion that they are made in order to naming. B. 3. c. 1. s. 3 he has these words: 'It is not enough for the perfection of language that sounds can be made signs of ideas, unless those signs can be so made use of as to comprehend several particular things: for the multiplication of words would have perplex'd their use, had every particular thing need of a distinct name to be signified by. To remedy this inconvenience language had yet a farther improvement in the use of general terms whereby one word was made to mark a number of particular existences, which advantageous use of sounds was obtained only by the difference of the ideas they were made signs of. Those names

[1] Instead of 'reciprocally.'
[2] Erased.
[3] Instead of 'who.'
[4] Within brackets in the MS.
[5] Instead of 'whereof.'

becoming general which are made to stand for general ideas, and those remaining particular where the ideas they are used for are particular.' Now I would fain know why a word may not be made to comprehend a great number of particular things in its signification, without the [1 help] of a general idea? Is it not possible to give the name [2 colour to black, white, and red, &c.] without having first made that strange and to me incomprehensible idea of [3 colour in abstract]? Or must we imagine that a child upon sight of a particular body, and being told it is called an apple, must first frame to himself an abstract general idea [4 exclusive of] all particular colour, tast, and figure before he can attain to the use of the word apple, and apply it to all the particulars of that sort of fruit that come in his way? [5 This surely is a task too hard and metaphysical to be perform'd by an infant just beginning to speak.] Nay, I appeal to the experience of any grown man, whether this be the course he takes in acquainting himself with the [6 right] use and signification of any word? Let any man take a fair and impartial view of his own thoughts, and then determine whether his general words do not become so only by being made to mark a number of particular existences, without any the least thought of abstraction. For what, I pray, are words but signs of our thoughts? and how are signs of any sort render'd universal otherwise than by being made to signify, or represent indifferently, a multitude of particular things?

The ideas that are in every man's mind ly hid[5den], and cannot of themselves be brought into the view of another. It was therefore necessary, for discourse and communication, that men should institute sounds to be signs of their ideas, which being [7 excited] in the mind of the hearer [8 might] bring along with them [6 into his understanding] such ideas as in the propriety of any language were annex'd to them. But because of the almost infinite number and variety of our [9 ideas], it is impossible, and if it were possible would yet be a useless thing, to appropriate a particular [5 word to a] sign or name to every one of them. From which it must necessarily follow, that one word be made the sign of a great number of particular ideas, between which there is some likeness and which are said to be of the same sort. [10 But then these sorts are not

[1] Instead of 'interposition.'
[2] Instead of 'man to Peter, James, and John.'
[3] Instead of 'man which shall have nothing particular in it.'
[4] Instead of 'thereof, abstracting from.'
[5] Erased.
[6] Instead of 'proper.'
[7] Instead of 'raised.'
[8] Instead of 'shall.'
[9] Instead of 'thoughts.'
[10] Erased. On the opposite page we have—'Every one's experience may convince him that this is all that's meant by general names, and that they do not stand either for universal natures distinct from our

determin'd and set out by nature, as was thought by most philosophers. Nor yet are they limited by any precise abstract ideas settl'd in the mind, with the general name annexed to them, as is the opinion of the authour of the *Essay*, nor do they in truth seem to me to have any precise bounds or limits at all. For if [there were] they had I do not see how there could be those doubts and scruples about the sorting of particular beings which [that authour insists on as a good proof] are observ'd sometimes to have happen'd. Neither do I think it necessary the kinds or species of things should be so very accurately bounded and marked out, language being made by and for the common use of men, who do not ordinarily take notice of the minuter and less considerable differences of things.] From [[1]all] which to me it seems evident that the having of general names does not imply the having of general ideas, but barely the marking by them a number of particular ideas, and that all the ends of language may be and are attain'd without the help of any such faculty as abstraction.

Which will be made yet more manifest if we consider the different manners wherein words [[1]and ideas [are] do stand for and represent things] represent ideas, and ideas things. There is no similitude or resemblance betwixt words and the ideas that are marked by them. Any name may be used indifferently for the sign of any idea, or any number of ideas, it not being determin'd by any likeness to represent one more than another. But it is not so with ideas in respect of things, of which they are suppos'd to be the copies and images. They are not thought to represent them [[1]any] otherwise than as they resemble them. Whence it follows that an idea is not capable of representing indifferently anything [[2]whatsoever], it being limited by the likeness it beares to some particular [[3]thing] to represent it rather than any other. The word man may equally be put to signify any particular man I can think of. But I cannot frame an idea of man which shall equally represent and correspond to each particular of that sort of creatures that may possibly exist.

I shall [[1]only] add one more passage out of the *Essay on Human Understanding*, which is as follows: 'Abstract ideas are not so obvious or easy to children or the yet unexercised mind as particular ones. If they seem so to grown men 'tis only because by constant and familiar use they are made so. For when we nicely reflect upon them we shall find that general

conceptions as was held by the Peripatetics and generality of the Schoolmen, nor yet for universal notions or ideas as is the opinion of that sort of Schoolmen called Nominals and of the authour of the *Essay*.

[1] Erased.

[2] Instead of 'or number of things.'

[3] Instead of 'existence.'

ideas are fictions and contrivances of the mind that carry difficulty with them and do not so easily offer themselves as we are apt to imagine. For example, does it not require some pains and skill to form the general idea of a triangle (which is yet none of the most abstract, comprehensive and difficult), for it must be neither oblique nor rectangle, neither equilateral, equicrural, nor scalenon, but all and none of these at once? In effect, it is something imperfect, that cannot exist; an idea wherein some parts of several different and inconsistent ideas are put together. 'Tis true the mind in this imperfect state has need of such ideas, and makes all the hast to them it can, for the conveniency of communication and enlargement of knowledge, to both which it is naturally very much enclin'd; but yet one has reason to suspect such ideas are marks of our imperfection. At least this is enough to shew that the most abstract and general ideas are not those that the mind is first and most easily acquainted with, nor such as its earlyest knowledge is conversant about.' B. 4. c. 7. s. 9. If any man has the faculty of framing in his mind such an idea of a triangle as is here describ'd, it is in vain to pretend to dispute him out of it, nor would I go about it. All I desire is that every one would fully and certainly inform himself whether he has such an idea or no. And this, methinks, can be no hard task for any one to perform. What more easy than for any one to look a little into his own understanding, and there try whether he has, or can attain to have, an idea that shall correspond with the description here given of the general idea of a triangle which is neither oblique nor rectangle, neither equilateral, equicrural, nor scalenon, but all and none of these at once? He that can conceive such manifest contradictions and inconsistencys, 'tis fit he enjoy his privilege. For my part [[1]I am well assur'd][2] I have not the power of so doing, nor consequently of making to myself these general ideas; neither do I find that I have any need of them either for the conveniency of communication or the enlargement of knowledge[1]] for the conveniency of communication and enlargement of knowledge. For which I am not sorry, because it is here said one has reason to suspect such ideas are marks of our *imperfection*. Tho', I must own, I do not see how this agrees with what has been above quoted [out of the same authour], viz. the having of general ideas is that which puts a perfect distinction betwixt man and brutes, and is an *excellency* which the faculties of brutes do by no means attain unto.]

It is observable [[3]what it is here said] of the difficulty that

[1] Erased.

[2] On opposite page—erased—'I must own I have so much of the brute in my understanding, that.'

[3] Instead of 'that which is [here] said by that authour on this occasion.'

abstract ideas carry with them, and the pains and skill that is requisite to the forming [[1] of] them. To the same purpose Aristotle (who was certainly a great admirer and promoter of the doctrine of abstraction) has these words: *σχεδὸν δὲ καὶ χαλεπώτατα γνωρίζειν τοῖς ἀνθρώποις ἐστὶ τὰ μάλιστα καθόλου· πορρωτάτω γὰρ τῶν αἰσθήσεών ἐστι.* There is scarce anything so incomprehensible to men as the most universal notions, because they are most remote from sense. *Metaph.* lib. i. cap. 2[2]. It is on all hands agreed, that there is need of great pains and toil and labour of the mind, to emancipate [[3] our thoughts] from particular ideas such as are taken in by the senses, and raise [[3] them] to those lofty speculations [[4] which] are conversant about abstract and universal ones.

From all which the natural consequence should seem to be, that so difficult a thing as the forming of abstract ideas is not necessary for communication, which is so easy and familiar to all sorts of men, even the most barbarous and unreflecting. But we are told, if they seem obvious and easy to grown men, 'tis only because by constant and familiar use they are made so. Now I would fain know at what time it is men are employ'd in surmounting that difficulty, and furnishing themselves with those necessary [[5] materials] of discourse. It cannot be when they are grown up, for then they are not conscious of any such pains-taking. It remains therefore to be the business of their childhood. And surely the great and multiply'd labour of framing general notions will be found a hard task for that tender age. Is it not a hard thing to imagine that a couple of children cannot commune one with another of their sugar-plumbs and rattles, and the rest of their little trinkets, till they have first tack'd together numberless inconsistencys, and so framed in their minds general abstract ideas, and annex'd them to every common name they make use of?

Nor do I think they are a whit more needful for enlargement of knowledge, than for communication. For tho' it be a point much insisted on in the Schools that all knowledge is about universals, yet I [[6] can by no means see the necessity of] this doctrine. It is acknowledg'd that nothing has a fairer title to the name of knowledge or science than geometry. Now I appeal to any man's thoughts whether, upon the entrance into that study, the first thing to be done is to try to conceive a circle that is neither great nor small, nor of any determinate radius, or to make ideas of triangles and parallelograms that

[1] Erased.

[2] Text as in Schwegler—*σχεδὸν δὲ καὶ χαλεπώτατα ταῦτα γνωρίζειν τοῖς ἀνθρώποις, τὰ μάλιστα καθόλου· πορρωτάτω γὰρ τῶν αἰσθήσεών ἐστιν.*

[3] Instead of 'it.'

[4] Instead of 'that.'

[5] Instead of 'præliminarys.'

[6] Instead of '[could never] bring myself to comprehend.'

are neither rectangular nor obliquangular, &c.? It is [1 true] one thing for a proposition to be universally true, and another for it to be about universal natures or notions. [2 Because] that the three angles of a triangle are equal to two right ones is granted to be a proposition universally true, it will not therefore follow that we are to understand it of universal triangles, or universal angles. It will suffice that it be true of [1 any particular tri] the particular angles of any particular triangle whatsoever.

But here it will be demanded, how we can know any proposition to be true of all particular triangles, except we have first seen it demonstrated of the general idea of a triangle, which equally agrees to and represents them all? For because a property may be demonstrated to belong to some one particular triangle, it will not thence follow that it equally belongs to [1 some] any other triangle which in all respects is not the same with the former. For instance, having demonstrated that the three angles of an isosceles, rectangular triangle are equal to two right ones, I cannot therefore conclude this affection agrees to all other triangles which have neither a right angle nor two equal sides. It seems therefore, that to be certain this proposition is universally true, we must either make a particular demonstration for every particular triangle, which is impossible, or else we must, once for all, demonstrate it of the general idea of a triangle in which all the particulars do indifferently partake, and by which they are all equally represented.

To which I answer, that notwithstanding the idea I have in my mind, whilst I make the demonstration, be that of some particular triangle, e.g. an isosceles, rectangular ones whose sides are of a determined length, I may nevertheless be certain that it extends to all other rectilinear triangles of what sort or bigness soever. And that because neither the right angle, nor the equality, nor determinate length of the legs are at all concern'd in the demonstration. 'Tis true the diagram I have in my view does include these particulars, but then there is not the least mention made of them in the proof of the proposition. It is not said the three angles are equal to two right ones, because one of them is a right angle, or because the legs comprehending it are [1 equal] of the same length; which sufficiently shews that the right angle might have been oblique and the sides unequal, and yet the demonstration have held good. And for this reason it is that I conclude that to be true of any obliquangular or scalenon which I had demonstrated of a particular right angled equicrural triangle; and not because I demonstrated the proposition of the general idea of a triangle which was all and none, it not being possible for me to conceive any triangle whereof I cannot delineate the like on paper. But I believe no man, whatever he may conceive, will pretend to

[1] Erased. [2] Instead of 'Thus [notwithstanding].'

describe a general triangle with his pencill. This being rightly consider'd, I believe we shall not be found to have any great [1 want] need of those eternal, immutable, universal ideas about which the philosophers keep such a stir, and without which they think there can be no silence at all.

But what becomes of these general maxims, these first principles of knowledge, [2 so frequently in the mouths] of [1 the] metaphysicians, all wch are suppos'd to be about abstract and universal ideas? To which all the answer I can make is, that whatsoever proposition is made up of terms standing for general notions or ideas, the same is to me, so far forth, [1 absolutely] unintelligible: and whether it be that those speculative gentlemen have by earnest and profound study attain'd to an elevation of thought above the reach of ordinary capacities and endeavours, or whatever else be the cause, sure I am there are in their writings many things which I now find myself unable to understand. Tho' being accustom'd to those forms of speech, I once thought there was no difficulty in them. But this one thing seems [1 to me] pretty plain and certain. How high soever that goodly fabrick of metaphysics might have been rais'd, and by what venerable names soever it may be supported, yet if [1 withall] it be built on [3 no other] foundation [4 than] inconsistency and contradictions, it is after all but a castle in the air[5].

It were an endless as well as an useless thing to trace the Schoolmen, those great masters of abstraction, and all others whether ancient or modern logicians and metaphysicians, thro' those numerous inextricable labyrinths of errour and dispute, which their doctrine of abstract natures and notions seems to have led them into. What bickerings and controversys, and what a learned dust has been rais'd about those matters, and what [1 great] mighty advantage has been from thence deriv'd to mankind, are things at this day too clear[illegible]wn to need to be insisted on by me. Nor has that do[illegible]n confined to those two sciences, that make the mos[illegible]ofession of it. The contagion thereof has spread [illegible] all the part of philosophy. It has invaded and [illegible]useful study of physic and divinity, and even t[illegible]e there have had their full share of it.

When men consider the gr[illegible] have [1 in] for so many ages [illegible] and advancement of the s[illegible] all this, the far greatest [illegible] uncertainties, and dispu[illegible] and even those that a[illegible]

[1] Erased.
[2] Instead of 'these cu[illegible]lations.'
[3] Instead of 'the[illegible]

clear and cogent demonstrations do contain in them paradoxes that are perfectly irreconcilable to the understandings of men, and that taking all together a very small portion of them does supply any real benefit to mankind, otherwise than by being an innocent diversion and amusement—I say upon the consideration of all this, men are wont to be cast into an amazement and despondency, and perfect contempt of all study. But that wonder and despair may perhaps cease upon a view of the false principles and wrong foundations of science [[1] which] that have been made use of. Amongst all which there is none, methinks, of a more wide and universal sway over the thoughts of studious men than that we have been endeavouring to detect and overthrow. [[1] To me certainly it does not seem strange that unprofitable debates and absurd and extravagant opinions should abound in the writings of those men who, disdaining the vulgar and obvious informations of sense, do in the depth of their understanding contemplate abstract ideas [2].]

I come now to consider the [[3] source] of this prevailing [[4] notion], and that seems to me most evidently to be language. And surely nothing of less extent than reason itself could have been the source of an opinion, as epidemical as it is absurd. That [[1] words are] the conceit of abstract idea ows its birth and origine to words, will appear, as from other reasons, so also from the plain confession of the ablest patrons of y^t^ doctrine, who [[1] do] acknowledge that they are made in order to naming; from which it is a clear consequence that there had been no such thing as speech, or universal signs, there never had been [[1] abstract ideas] any thought of abstract ideas. I find it also declared in express terms that general truths can never be well made known, and are very seldom apprehended but as conceived and expressed in words; all which doth plainly set forth the inseparable connexion and mutual dependence [[1] on each other] that is thought to be between words and abstract ideas. For whereas it is elsewhere said [[1] there could be no communication by general names [[5] without there being] also general ideas of which they were to be signs; we are here, on the other hand, told that] that general ideas [[6] are] necessary for communication by general names; here, on the other hand, we are told that names are needfull for the understanding of [[1] abstract notions] general truths. Now by the bye, I would fain know how it is possible for words to make a man apprehend that which he cannot apprehend without them. I do not deny they are necessary for communication, and so making me know the ideas that are in the mind of another. But when any truth,

[1] Erased.
[2] On margin—'Dec. 2.'
[3] Instead of 'cause.'
[4] Instead of 'imagination in the minds of men.'
[5] Instead of 'except there were.'
[6] Instead of 'were.'

whether [1 about general or part] about general or particular ideas, is once made known to me by words, [1 I cannot see any manner of] so that I rightly apprehend the ideas contained in it, I see no manner of reason why I may not omit the words, and yet retain as full and clear a conception of the ideas themselves, as I had [1 of them] while they were cloathed with words. Words being, so far as I can see, of use only for recording and communicating, but not absolutely apprehending [1 of] ideas. [1 I know there be some things which pass for truths that will not bear this [stripping—being stript] of the attire of words, but this I always took for a sure and certain sign that there were no clear and determinate ideas underneath.] I proceed to shew the manner wherein words have contributed to the growth and origine of that mistake.

That which seems [1 to me principally] in a great measure to have drove men into the conceit of [2 abstract] ideas, is the opinion, that every name has, or ought to have, one only precise and settl'd signification: which inclines [1 men] them to think there are certain abstract, determinate, general ideas that make the true and only immediate signification of each general name, and that it is by the mediation of these abstract ideas that a general name comes to signify any particular thing. Whereas there is in truth [3 a] diversity of significations in every general name whatsoever [1 except only the proper names]. Nor is there any such thing as one precise and definite signification annexed to each [1 appellative] name. All which does evidently follow from what has been already said, and will [1 be] clearly appear to any one by a little reflexion.

But [1 here] to this, I doubt not, it will be objected that every name that has a definition is thereby tied down and restrain'd to [4 one certain] signification, e. g. a triangle is defin'd to be a plain surface comprehended by three right lines, by which that name is limited to denote one certain idea, and no other. To which I answer, that in the definition it is not said, whether the surface be great or small, black or white or transparent, or whether the sides are long or short, equal or unequal, or with what angles they are inclin'd to each other. In all which there may be great variety, and consequently there is no one settled idea which limits the signification of the word triangle. 'Tis one thing for to keep a word [1 everywhere] constantly to the same definition, and another to make it stand everywhere for the same idea: [5 that] is necessary, but [6 this] is useless and impracticable. [1 Nor does it avail to say the abstract idea of a triangle, which bounds the signification of that name, is itself determin'd, tho' the angles, sides, &c. are

[1] Erased.
[2] Instead of 'general.'
[3] Instead of 'an homonomy or.'
[4] Instead of 'a particular.'
[5] Instead of 'the former.'
[6] Instead of 'the latter.'

not. For besides the absurdity of such an idea, which has been already shewn, it is evident that if the simple ideas or parts, i. e. the lines, angles, and surface, are themselves various and undetermin'd, the complex idea or whole triangle cannot be one settled determinate idea.]

[[1] But to give a farther account, how words came to introduce the doctrine of universal ideas, it will be necessary to observe there is a notion current among those that pass for the deepest thinkers, that every significant name stands for an idea. It is said by them that a proposition cannot otherwise be understood than by perceiving [[2] the agreement or disagreement of] the ideas marked by the terms [[3] thereof] of it. Whence it follows, that according to those men every proposition that is not jargon must consist of terms or names that carry along with them each a determinate idea. This being so, and it being [certain] withall certain that names which yet are not thought altogether insignificant do not always mark out particular ideas, it is straightway concluded that they stand for general ones.

[1] On the opposite page, we have, instead of this paragraph, the following:—'But to give a farther account how words came to introduce the doctrine of general ideas, it [* must be observ'd] that [† it is a receiv'd opinion] that language hath no other end than the communicating our ideas, and that every significant name stands for an idea. This being so, and it being withall certain that names which yet are not thought altogether insignificant, do not always mark out particular ideas, it is straightway concluded that they stand for general ones.

'That there are many names in use amongst speculative men, which do not always suggest to others determinate, particular ideas, or in truth anything at all, is what nobody will deny. [‡ And that there are significant names denoting things, whereof it is a direct repugnancy that any idea should be form'd by any understanding whatsoever, I shall in its due place endeavour to demonstrate that it is] not necessary (even in the strictest reasonings) that significant names which [‡ are marks of ideas] stand for ideas shou'd every time they are used excite in the understanding the ideas they are made to [‡ signify] stand for. In reading and discoursing names are for the [‡ thinking on] most part us'd as [‡ figures in casting up a sum in which to compute exactly is not necessary] letters are in Algebra, in which, tho' a particular quantity be mark'd by each letter, yet to proceed right it is not requisite that in every step [‡ you have these particular quantitys in y[r] view. Tho' you regard only the letters themselves without ever thinking on what was denoted by them, yet if you work according to rule, you will come to a true solution of the question] each letter suggest to your thoughts that particular quantity [§ which] it was appointed to [‖ stand for].

[2] Erased.

[3] This and some words that follow are within brackets in the MS.

* Instead of 'is necessary to observe.'

† Instead of 'the common opinion of philosophers is.'

‡ Erased.

§ Instead of 'whereof.'

‖ Instead of 'be the figure to make—denote.'

In answer to this I say, that names, significant names, do not always stand for ideas, but that they may be and are often used to good purpose [tho' they are] without being suppos'd to stand for or represent any idea at all. And as to what we are told of understanding propositions by [perceiving] the agreement or disagreement of the ideas marked by their terms, this to me in many cases seems absolutely false. For the better clearing and demonstrating of all which I shall make use of some particular instances. Suppose I have the idea of some one particular dog to which I give the name Melampus, and then frame this proposition—Melampus is an animal. Where 'tis evident the name Melampus denotes one popular idea. And as for the other name or term of the proposition, there are a sort of philosophers will tell you thereby is meant not only a universal conception, but also [corresponding thereto] a universal nature or essence really existing without the mind, whereof Melampus doth partake, as tho' it were possible that even things themselves could be universal. And [But] this with reason, is exploded as nonsensical and absurd. But then those men who have so clearly and fully detected the emptyness and insignificancy of that wretched jargon [of S.G.W. (?)], are themselves to me equally unintelligible. For they will have it that if I understand what I say I must make the name animal stand for an abstract general idea which agrees to and corresponds with the particular idea marked by the name Melampus. But if a man may be allow'd to know his own meaning, I do declare that in my thoughts the word animal is neither suppos'd to stand for an universal nature, nor yet for an abstract idea, which to me is at least as absurd and incomprehensible as the other. Nor does it indeed in that proposition stand for any idea [at all] at all. All that I intend to signify thereby being only this—that the particular [creature] thing I call Melampus has a right to be called by the name animal. And I do intreat any one to make this easy tryal. Let him but cast out of his [thoughts] the words of the proposition, and then see whether two clear and determinate ideas remain [[1] in his understanding] whereof he finds one to be conformable to the other. I perceive it evidently in myself that upon laying aside all thought of the words 'Melampus is an animal,' I have remaining in my mind one only naked and bare idea, viz. that particular one to which I gave the name Melampus. Tho' some there be that pretend they have also a general idea signified by the word animal, which they perceive to agree with the particular idea signified by the word Melampus, [which idea is made up of inconsistencys and contradictions, as has been already shewn.] Whether this or that

[1] Erased.

be the truth of the matter, I desire every particular person to consider and conclude for himself.]

And this methinks may pretty clearly inform us how men might first have come to think there was a general idea of animal. For in the proposition we have instanc'd in, it is plain the word animal is not suppos'd to stand for the idea of any one particular [animal] [creature] animal. For if it be made stand for another different from that is marked by the name Melampus, the proposition is false and includes a contradiction; and if it be made signify the very same individual that Melampus doth, it is a tautology. But it is presumed that every name stands for an idea. It remains therefore that the word animal stands for [the] general abstract idea [of animal]. In like manner we may be able with a little attention to discover how other general ideas [of all sorts] might at first have stolen into the thoughts of man.

But farther to make it evident that words may be used to good purpose without bringing into the mind determinate ideas, I shall add this instance. We are told [that] the good things which God hath prepared for them that love Him are such as eye hath not seen nor ear heard, nor hath it enter'd into the heart of man to conceive. What man will pretend to say these words of the inspir'd writer are empty and [ses (?)] insignificant? And yet who is there that can say they bring into his mind [determi] clear and determinate ideas, or in truth any ideas at all [ideas] of the good things [pre] in store for them that love God? It may perhaps be said that those words lay before us the clear and determinate abstract ideas of good in general and thing in general; but I am afraid it will be found that those very abstract ideas are every whit as remote from the comprehension of men as the particular pleasures of the saints in heaven. But, say you, those words of the Apostle must have some import. They cannot be suppos'd to have been utter'd without all meaning and design whatsoever. I answer, the saying is very weighty, and carrys with it a great design, but it is not to raise in the minds of men the abstract ideas of thing or good, nor yet the particular ideas of the joys of the blessed. The design is to make them more chearfull and fervent in their duty; and how this may be compass'd without making the words good things [to be] stand for and mark out to our understandings any ideas either general or particular, I proceed to shew.

Upon mention of a reward to a man for his pains and perseverance in any occupation whatsoever, it seems to me that divers things do ordinarily ensue. For there may be excited in his understanding an idea of the particular good thing to him proposed for a reward. There may also ensue thereupon an alacrity and steddiness in fulfilling those conditions on which it is to be obtain'd, together with a zealous desire of

serving and pleasing the person in whose power it is to bestow that good thing. All these things, I say, may and often do follow upon the pronunciation of those words that declare the recompence. Now I do not see any reason why the latter may not happen without the former. What is it that hinders why a man may not be stirr'd up to diligence and zeal in his duty, by being told he shall have a good thing for his reward, tho' at the same time there be excited in his mind no other idea than barely those of sounds or characters? When he was a child he had frequently heard those words used to him to create in him an obedience to the commands of those that spoke them, and as he grew up he has found by experience that upon the mentioning of those words by an honest man it has been his interest to have doubled his zeal and activity for the service of that person. Thus there having grown up in his mind a customary connexion betwixt the hearing that proposition and being disposed to obey with cheerfulness the injunctions that accompany it, methinks it might be made use of, tho' not to introduce into his mind any idea marked by the words good thing, yet to excite in him a willingness to perform that which is requir'd of him. And this seems to me all that is design'd by the speaker, except only when he intends those words shall [be the mark of] signifie the idea of some particular thing: e.g. in the case I mention'd 'tis evident the Apostle never intended the words [good things] should [mark out to] our understandings the ideas of those particular things our faculties never attain'd to. And yet I cannot think that he used them at random and without design; on the contrary, it is my opinion that he used them to very good purpose, namely, to beget in us a cheerfulness and zeal and perseverance in well-doing, without any thought of introducing into our minds the abstract idea of a good thing. If any one will joyn ever so little reflexion of his own to what has been said, I doubt not it will evidently appear to him that general names are often used in the propriety of language without the speaker's designing them for marks of ideas in his own which he would [them] have them raise in the understanding of the hearer.

[1 Even] proper names themselves are not always spoken with a design to bring into our view the ideas of those particular things that are suppos'd to be annex'd to them. For example, when a Schoolman tells you that Aristotle hath said it, think you that he intends [2 thereby] to [ra] excite in your imagination the idea of that particular man? All he means by it is only to dispose you to receive his opinion with that deference and submission that custom has annex'd to that name. When a man that has been accustom'd to resign his judgment [of] to the authority of that philosopher [shall] [upon] in reading of

[1] 'Nor is it less certain that' erased. [2] Erased.

a book meet with the letters that compose his name, he forthwith yields his assent to the doctrine it was brought to support, and that with such a quick and sudden [1 glance of thought] as it is impossible any idea either of the person or writings of that man should go before—so close and immediate a connexion has long custom establish'd betwixt the very word Aristotle and the motions of assent and reverence in the minds of some men.

I intreat the reader to reflect with himself, and see if it does not oft happen, either in hearing, or reading a discourse, that the passions of delight, love, hatred, admiration, disdain, &c. [2 do not] arise immediately in his mind upon the perception of certain words without any ideas coming between. At first, indeed, the words might have occasion'd ideas that may be apt to produce those emotions of mind. But if I mistake not, it will be found that when language is once grown familiar, [3] to a man the hearing of the sound or light of the characters is oft immediately attended with those passions which at first were wont to be produc'd by the intervention of ideas that are now quite omitted.

[4 Further], the communicating of ideas marked by words is not the chief and only end of language, as is commonly suppos'd. There are other ends, as the raising of some passion, the exciting to or deterring from an action[5]. To which the former is in many cases barely subservient, and sometimes [6] entirely omitted when these can be obtain'd without it, as I think does not infrequently happen in the familiar use of language.

I ask any man whether [7 every time] he tells another that such an action is honourable and vertuous, with an [8] intention to excite him to the performance of it, he has at that instant ideas of honour and virtue[9] in his [thoug] view, and whether in reality his intention be to raise [10 that] idea, together with their agreement to the [2 particular] idea of that particular action, in the understanding of him he speaks to [2 or rather whether this be not his full purpose, namely, that those words should excite in the mind of the hearer an esteem of that particular action, and stir him up to the performance of it].

[1] 'action of the mind'—on opposite page.

[2] Erased.

[3] 'to a man' erased.

[4] 'From which it follows, that' erased.

[5] On opposite page—'the putting the mind in some particular disposition. Hence we may conceive how it is possible for the promise that is made us of the good things of another life excite in us suitable dispositions, tho' the words *good things* do not bring into our minds particular ideas of the pleasures of heaven, nor yet the ideas of good in general or things in general.'

[6] 'entirely' erased.

[7] 'when' erased.

[8] 'vertuous with an' substituted for 'vertuous.'

[9] 'virtue' substituted for 'vertue.'

[10] 'those abstract' erased.

[[1] Upon hearing the words lie [&] rascal, indignation, revenge, and the suddain motions of anger do instantly [ensue] in the minds of some men, without our attending to the definition of those names or concerning the ideas they are suppos'd to stand for—all that passion and resentment having been by custom connected to those very sounds themselves and the manner of their utterance[2].]

It is plain therefore that a man may understand what is said to him without having a clear and determinate idea annexed to and marked by every particular [[3] word] in the discourse he hears. Nay, he may perfectly understand it. For what is it, I pray, to understand perfectly, but only to understand all that is meant by the person that speaks? which very oft is nothing more than barely to excite in [[4] his mind] certain emotions without any thought of those ideas so much talk'd of and so little understood. For the truth whereof I appeal to every [man's] one's experience.

I know not how this doctrine will go down with those [philosophers] who may be apt to give the titles of gibberish and jargon to all discourse whatsoever so far forth as the words contained in it are not made the signs of clear and determinate ideas, who think it nonsense for a man to assent to any proposition each term whereof doth not bring into his mind a clear and distinct idea, and tell us [[1] over and over] that every pertinent [[5] word] [[6] hath an idea annexed unto] which never fails to accompany it where 'tis rightly understood. Which opinion of theirs, how plausibly soever it might have been maintain'd by some, seems to me to have introduced a great deal of difficulty and nonsense into the reasonings of men. Certainly nothing could be fitter to bring forth and cherish the doctrine of abstract ideas. For when men were indubitably conscious to themselves that many [[7] words] they used did not denote any particular ideas, lest they should be thought altogether insignificant, they were of necessity driven into the opinion that they stood for [[8] general ones].

But more effectually to shew the absurdity of an opinion that carrys with it so great an appearance of [clearness and strength of] reason, but is [[9] in fact] most dangerous and destructive both to reason and religion, I shall, if I mistake not, in the progress of this work demonstrate there be names well known and

[1] Erased.

[2] On opposite page—'Innumerable instances of this kind may be given—arise. But why should I be tedious in enumerating these things, which every one's observation will, I doubt not, plentifully suggest unto him?'

[3] 'name'—on opposite page.

[4] 'the hearer'—on opposite page.

[5] 'name'—on opposite page.

[6] 'is the mark of an idea'—on opposite page.

[7] 'names'—on opposite page.

[8] 'good sense and sound'—on opposite page.

[9] Instead of 'withall.'

familiar to men, which tho' they mark and [stand] and signify things, cannot be suppos'd to signifie ideas of any sort, either general or particular, without the greatest nonsense and contradiction; it being absolutely impossible, and a direct repugnancy, that any intellect, how exalted and comprehensive soever, should frame ideas of these things.

We have, I think, shewn the impossibility of abstract ideas. We have consider'd what has been said in behalf of them by their ablest patrons, and endeavour'd to demonstrate they are of no use for those ends to which they [1] are thought necessary. And, lastly, we have traced them to the source from whence they flow, which appears evidently to be language.

Since therefore words have been discover'd to be so very apt to impose on the understandings of men, I am resolv'd in my [2] inquiries] to make as little use of them as possibly I can. Whatever ideas I consider, I shall endeavour to take them bare and naked into my view, keeping out of my thoughts, so far as I am able, those names which long and constant use hath so strictly united to them.

Let us conceive a solitary man, one born and bred in such a place of the world, and in such circumstances, as he shall never have had occasion to make use of universal signs for his ideas. That man shall have a constant train of particular ideas passing in his mind. Whatever he sees, hears, imagines, or anywise conceives, is on all hands, even by the patrons of abstract ideas, granted to be particular. Let us withall suppose him under no necessity of labouring to secure himself from hunger and cold, but at full ease, naturally of good facultys, [3 and] contemplative. Such a one I should take to be nearer the discovery of certain great and excellent truths yet unknown, than he that has had the education of schools, [4 has been instructed in the ancient and modern philosophy], and by much reading and conversation has [furnish'd his head] attain'd to the knowledge of those arts and sciences that make so great a noise in the [4 learned] world. It is true, the knowledge of our solitary philosopher is not like to be so very wide and extended, it being confin'd to those few particulars that come within his own observation. But then, if he is like to have less knowledge, he is withall like to have fewer mistakes than other men.

It cannot be deny'd that words are of excellent use, in that by their means all that stock of knowledge, which has been purchas'd by the joynt labours of inquisitive men in all ages and nations, may be drawn into the view, and made the possession of one [4 particular] single person. But there [5 are some] parts of learning which contain the knowledge of things the

[1] 'are' instead of 'were.' [2] Instead of 'reasonings.'
[3] 'but' erased. [4] Erased.
[5] Instead of 'is one.'

most noble and important of any within the reach of human reason, that have had the ill fate to be so signally perplex'd and darken'd by the abuse of words and general ways of speech wherein they are deliver'd, that in the study [1 of them] a man cannot be too much upon his guard, [2 whether] in his private meditations, or in reading the writings or hearing the discourses of other men, to prevent his being cheated [3 by the glibness and familiarity of speech] into a belief that those words stand for ideas which, in truth, stand for none at all: which grand mistake it is almost incredible what a mist and darkness it has cast over the understandings of men, otherwise the most rational and clear-sighted.

I shall therefore endeavour, so far as I am able, [4 to put myself in the posture of the solitary philosopher. I will confine my thoughts and enquiries to the naked scene of my own particular ideas,] from which I may expect to derive the following advantages.

First. I shall be sure to get clear of all [3 verbal] controversies purely verbal. The [5 springing up of] which weeds in almost all the sciences has been [3 the] a most fatal obstruction to the growth of true and sound knowledge: and accordingly is at this day esteem'd as such, and made the great and just complaint of the wisest men.

Secondly. 'Tis reasonable to expect that [6 by this] the trouble of sounding, or examining, or comprehending any notion may be very much abridg'd. For it oft happens that a notion, when it is cloathed with words, seems tedious and operose, and hard to be conceiv'd, which yet being stript of that garniture, the ideas shrink into a narrow compass, and are view'd almost by one glance of thought.

Thirdly. I shall have fewer objects to consider than other men seem to have had. [7 Because] I find myself to want several of those supposed ideas, in contemplating of which the philosophers do usually spend much pains and study. [8 nay, even of those (which without doubt will appear very surprising) that pass for simple, particular ideas. It [is inconceivable what] cannot be believ'd what a wonderfull emptyness and scarcity of ideas that man shall descry who will lay aside all use of words in his meditations.

Fourthly. Having remov'd the veil of words, I may expect to have a clearer prospect of the ideas that remain in my understanding. To behold the deformity of errour we need only undress it.]

[1] Instead of 'thereof.'
[2] Instead of 'either.'
[3] Erased.
[4] Erased. On the opposite page —'to take off the mask of words, and obtain a naked view of my own particular ideas.'
[5] Instead of 'insisting on.'
[6] Instead of 'hereby.'
[7] Instead of 'For that.'

Fifthly. This seemeth to be a sure [1 way] to extricate myself out of that fine and subtile net of abstract ideas; which has so miserably perplex'd and entangled the minds of men, and that with this peculiar circumstance, that by how much the finer and the more curious was the wit of any man, by so much the deeper was he like to be ensnar'd and faster held therein.

Sixthly. So long as I confine my [2 thoughts] to my own ideas divested of words, I do not see how I can easily be mistaken. The objects I consider I [3 clearly] and adequately know. I cannot be deceiv'd in thinking I have an idea which I have not. Nor, on the other hand, can I be ignorant of any idea that I have. It is not possible for me to think any of my own ideas are alike or unlike which are not truly so. To discern the agreements and disagreements there are between my ideas, to see what simple ideas are included in any [4 compound] idea, and what not, [5 there is nothing requisite but] an attentive perception of what passes in my own understanding.

But the attainment of all these advantages does presuppose an entire deliverance from the deception of words, which I dare scarce promise myself. So difficult a thing it is to dissolve a union so early begun, and confirm'd by so long a habit, as that betwixt words and ideas.

Which difficulty seems to have been very much encreas'd by the [6 doctrine of abstraction]. For so long as men thought abstract ideas were annex'd to their words, it does not seem strange they should use words for ideas. It being found an impracticable thing to lay aside the word and retain the abstract idea in the mind, which in itself was perfectly inconceivable. This made it necessary for them to reason and meditate about words, to which they suppos'd abstract ideas were connected, and by means whereof they thought those ideas could be conceiv'd, tho' they could not without them. [7 But surely those ideas ought to be suspected that cannot endure the light without a covering.]

Another thing which makes words and ideas thought much [8 harder to separate] than in truth they are, is the opinion that every name stands for an idea. [9 For] it is no wonder that men should fatigue themselves in vain, and find it a very difficult undertaking, when they endeavour'd to [10 obtain a clear

[1] Instead of 'means whereby.'
[2] Instead of 'contemplations.'
[3] Instead of 'perfectly.'
[4] Instead of 'complex.'
[5] Erased here—'all this I can do without being taught by [another], there being requisite thereto nothing more than.' Also—['the writings and discoveries of other men or without having any great parts of my own] . . . there is nothing more requisite.'
[6] Instead of 'opinion of abstract ideas.'
[7] Erased.
[8] Instead of 'more inseparable.'
[9] Instead of 'Now.'
[10] Instead of 'strip and take a.'

and naked] view of [1 those] the ideas marked by those words, which in truth mark none at all; [1 as I have already shewn many names often do not, even when they are not altogether [insignificant], and I shall more fully shew it hereafter].

[2 This] seems to me the principal cause why those men that have so emphatically recommended to others the laying aside the use of words in their meditations, and contemplating their bare ideas, have yet been so little able to perform it themselves. Of late many have been very sensible of the absurd opinions, and insignificant disputes, that grow out of the abuse of words. In order to redress these evils, they advise well that we attend to the ideas that are signified, and draw off our attention from the words that signify them. But how good soever this advice may be that they have given others [3 men, it is plain they little regarded it themselves, so long as they thought the only immediate use of words was to signifie ideas, and that the immediate signification of every general name was a determinate abstract idea.

Which having been shewn to be mistakes, a man may now, with much greater ease, deliver himself from the imposture of words. He that knows he hath no other than particular ideas, will not puzzle himself in vain to find out and conceive the abstract idea annexed to any name. And he that knows names [1 when made use of in the propriety of language] do not always stand for ideas, will spare himself the labour of looking for ideas where there are none to be had. Those obstacles being now remov'd, I earnestly desire that every one would use his utmost endeavour to attain a clear and naked view of [4 the] ideas he would consider [5 by separating] from them all that varnish and mist of words, which so fatally blinds the judgment and dissipates the attention of men.

This is, I am confident, the shortest way to knowledge, and cannot cost too much pains in coming at. In vain do we extend our view into the heavens, and rake into the entrails of the earth. In vain do we consult the writings and discourses of learned men, and trace the dark footsteps of antiquity. We need only draw the curtain of words, to behold the fairest tree of knowledge, whose fruit is excellent and within the reach of [6 our hand].

Unless we take care to clear the first principles of knowledge from the [7 incumbrance and delusion] of words, [1 the consequences we draw from them] we may make infinite reasonings upon them to no purpose. We may [8 deduce consequences

1 Erased.
2 Instead of 'These.'
3 'men' erased.
4 Instead of 'his own.'
5 Instead of 'having separated.'
6 Instead of '[any man] to pluck it.'
7 Instead of 'cheat.'
8 Instead of 'lose ourselves in.'

from] consequences, and be never the wiser. The farther we go, we shall only lose ourselves the more irrecoverably, and be the deeper entangled in difficulties and mistakes.

I do therefore intreat whoever designs to read the following sheets, that he would make my words the occasion of his own thinking, and endeavour to attain the same train of thoughts in reading that I had in writing them. By this means it will be easy for him [[1]to discover the truth or falsity of what I say]. He will be out of all danger of being deceiv'd by my words. And I do not see what inducement he can have to err in considering his own naked, undisguised ideas.

That I may contribute, so far as in me lies, to expose my thoughts [[2]to the] fairly to the understanding of the reader, I shall throughout endeavour to express myself in the clearest, plainest, and most familiar [3] manner, abstaining from [[2]all flourish and pomp of words], all hard and unusual terms which are [[2]commonly] pretended by those that use them to cover a sense [[2]intricate and] abstracted and sublime.

[[2]I pretend not to treat of anything but what is obvious and [[2]accommodated to] the understanding of every reasonable man.]

[1] Instead of 'whatever mistakes I might have committed.'
[2] Erased.
[3] After 'manner' 'I shall' erased.

B

ARTHUR COLLIER

THE simultaneous publication, without mutual communication, of a conception of the nature of sensible reality so far accordant as that of Berkeley and Collier is a curious coincidence, and I am induced to reprint the Introduction to Collier's *Clavis Universalis: or, a new Inquiry after Truth, being a Demonstration of the Non-existence, or Impossibility, of an External World*[1], which appeared in the spring of 1713.

Arthur Collier was born in October, 1680—more than four years before Berkeley—at the rectory of Langford Magna in Wiltshire. He entered Pembroke College, Oxford, in July 1697. He succeeded his father as rector of Langford Magna in 1704, and continued to hold that living till his death in 1732. One of his near neighbours, during the first years of his incumbency, was John Norris, the English Malebranche, rector of Bemerton, author of *An Essay towards the Theory of the Ideal or Intelligible World* (1701–4), who died in 1711.

By his own account, Collier adopted his thought regarding the material world about 1703, although he did not publish it until 1713.

Five interesting letters of Collier, in exposition and defence of his notion of Matter, are given in his *Memoirs* by Benson. Two of them were written in 1714, and the others in 1715, 1720, and 1722. That written in 1715 is addressed to Dr. Samuel Clarke; two are to Samuel Low, a grammarian; another was sent to Dr. Waterland; and the last is addressed to Mr. Shepherd, a Fellow of Trinity College, Oxford.

Collier is more disposed than Berkeley to employ abstract speculation in theology and otherwise. His theological speculations occupied a considerable share of his life. They involve a subtle modification of Arianism—according to which the sensible world exists in the minds of men; the mind of man exists in Christ; and Christ exists in God—all exemplifying what he calls

[1] The motto of this work, taken from Malebranche, is *Vulgi assensus et approbatio, circa materiam difficilem, est certum argumentum falsitatis istius opinionis cui assentitur.* —De Inquir. Verit. Lib. III. p. 194.

'inexistence,' or dependent existence. This chain of *inexistent* being he deduces by reasoning, confirmed by Scripture. Collier was a friend and correspondent of Whiston. He was a Tory and High Churchman, and curiously, like Berkeley, he published a sermon on the Christian obligation of passive submission to established government, founded on Romans xiii. 1.

It does not appear that Berkeley and Collier ever met, nor is he named by Berkeley in his works, although Berkeley is more than once named by him. But Berkeley, as we have seen, refers to the *Clavis* in one of his letters to Lord Percival.

THE INTRODUCTION TO THE CLAVIS UNIVERSALIS

'Wherein the Question in General is explained and stated, and the whole subject divided into two particular heads.

'THOUGH I am verily persuaded that, in the whole course of the following treatise, I shall or can have no other adversary but prejudice; yet, having by me no mechanical engine proper to remove it; nor being able to invent any other method of attacking it, besides that of fair reason and argument; rather than the world should finish its course without once offering to inquire in what manner it exists, (and for one reason more, which I need not name, unless the end desired were more hopeful); I am at last, after a ten years' pause and deliberation, content to put myself upon the trial of the common reader, without pretending to any better art of gaining him on my side, than that of dry reason and metaphysical demonstration.

'The Question I am concerned about is in general this—Whether there be any such thing as an External World. And my title will suffice to inform my reader, that the *negative* of this question is the point I am to demonstrate.

'In order to which, let us first explain the terms.

'Accordingly, by *World*, I mean whatsoever is usually understood by the terms body, extension, space, matter, quantity, &c., if there be any other word in our English tongue which is synonymous with all or any of these terms.

'And now nothing remains but the explication of the word *External*.

'By this, in general, I understand the same as is usually understood by the words, absolute, self-existent, independent, &c.; and this is what I deny of all matter, body, extension, &c.

'If this, you will say, be all that I mean by the word external, I am like to meet with no adversary at all, for who has ever affirmed, that matter is self-existent, absolute, or independent?

'To this I answer, What others hold, or have held in times past, I shall not here inquire. On the contrary, I should be glad to find by the event, that all mankind were agreed in that which I contend for as the truth, viz. that matter is not, cannot be, independent, absolute, or

self-existent. In the mean time, whether they are so or no, will be tried by this.

'Secondly, and more particularly, That by not independent, not absolutely existent, not external, I mean and contend for nothing less than that all matter, body, extension, &c., exists in, or in dependence on, mind, thought, or perception; and that is not capable of an existence, which is not thus dependent.

'This perhaps may awaken another to demand of me, How? to which I as readily answer—just how my reader pleases, provided it be somehow. As for instance, we usually say, An *accident* exists in, or in dependence on, its proper subject; and that its very essence, or reality of its existence, is *so* to exist. Will this pass for an explication of my assertion? If so, I am content to stand by it, in this sense of the words. *Again*, we usually say (and fancy too we know what we mean in saying), that a body exists in, and also in dependence on, its proper *place*, so as to exist necessarily in some place or other. Will this description of dependence please my inquisitive reader? If so, I am content to join issue with him, and contend that all matter exists in, or as much dependently on, mind, thought, or perception, to the full, as anybody exists in place. Nay, I hold the description to be so just and apposite as if a man should say, A thing is like itself: for, I suppose I need not tell my reader that when I affirm that all matter exists in mind, after the same manner as body exists in place, I mean the very same as if I had said, that mind itself is the place of body, and so its place, as that it is not capable of existing in any other place, or in place after any other manner. *Again, lastly*, it is a common saying, that an object of perception exists in, or in dependence on, its respective *faculty*. And of these objects there are many who will reckon with me, light, sounds, colours, and even some material things, such as trees, houses, &c., which are seen, as we say, *in* a looking-glass, but which are, or ought to be, owned to have no existence but *in*, or *respectively on*, the minds or faculties of those who perceive them. But, to please all parties at once, I affirm that I know of no manner in which an object of perception exists in, or on, its respective faculty, which I will not admit in this place to be a just description of that manner of *in-existence* after which all matter that exists is affirmed by me to *exist in mind*. Nevertheless, were I to speak my mind freely I should choose to compare it to the inexistence of some, rather than some other objects of perception —particularly such as are objects of the sense of vision; and of these, those more especially which are allowed by others to exist wholly in the mind or visive faculty; such as objects seen in a looking-glass, by men distempered, light-headed, ecstatic, &c., where not only colours, but entire bodies, are perceived or seen. For these cases are exactly parallel with that existence which I affirm of all matter, body, or extension whatsoever.

'Having endeavoured, in as distinct terms as I can, to give my reader notice of what I mean by the proposition I have undertaken the defence of, it will be requisite, in the next place, to declare in as plain terms, what I do *not* mean by it.

'Accordingly, I declare in the *first* place, That in affirming that there is no external world, I make no doubt or question of the *existence* of

bodies, or whether the bodies which are seen exist or not. It is with me a first principle, that *whatsoever is seen*, is. To deny or doubt of this is errant scepticism, and at once unqualifies a man for any part or office of a disputant, or philosopher; so that it will be remembered from this time, that my inquiry is not concerning the existence, but altogether concerning the *extra*-existence of certain things or objects; or, in other words, what I affirm and contend for, is not that bodies do not exist, or that the external world does not exist, but that such and such bodies, which are supposed to exist, do not exist externally; or in universal terms, that there is no such thing as an external world.

'*Secondly*, I profess and declare that, notwithstanding this my assertion, I am persuaded that I see all bodies just as other folks do; that is, the visible world is seen by me, or, which is the same, seems to me, to be as much external or independent, as to its existence, on my mind, self, or visive faculty, as any visible object does, or can be pretended to do or be, to any other person. I have neither, as I know of, another nature, nor another knack of seeing objects, different from other persons, suitable to the hypothesis of their existence which I here contend for. So far from this, that I believe, and am very sure, that this seeming, or (as I shall desire leave to call it) *quasi externeity* of visible objects, is not only the effect of the Will of God, (as it is His Will that light and colours should seem to be without the soul, that heat should seem to be in the fire, pain in the hand, &c.) but also that it is a natural and necessary *condition* of their visibility: I would say that though God should be supposed to make a world, or any one visible object, which is granted to be not external, yet, by the condition of its being seen, it would, and must be, *quasi external* to the perceptive faculty; as much so to the full, as is any material object usually seen in this visible world.

'Moreover, *thirdly*, When I affirm that all matter exists dependently on mind, I am sure my reader will allow me to say, I do not mean by this—that matter or bodies exist in *bodies*. As for instance, when I affirm or say, that the world, which I see, exists in my mind, I cannot be supposed to mean that one body exists in another, or that all the bodies which I see exist in that which common use has taught me to call *my body*. I must needs desire to have this remembered, because experience has taught me how apt persons are, or will be, to mistake me in this particular.

'*Fourthly*, When I affirm that this or that visible object exists in, or dependently on, my mind, or perceptive faculty, I must desire to be understood to mean no more than I say, by the words *mind* and *perceptive faculty*. In like manner I would be understood, when I affirm in general, that all matter or body exists in, or dependently on, mind. I say this to acquit myself from the imputation of holding that the mind causes its own ideas, or objects of perception; or, lest any one by a mistake should fancy that I affirm—that matter depends for its existence on the will of man, or any creature whatsoever. But now, if any such mistake should arise in another's mind, he has wherewith to rectify it; inasmuch as I assure him, that by *mind*, I mean that part, or act, or faculty of the soul which is distinguished by the name *intellective* or *perceptive*; as in exclusion of that other part which is distinguished by the term *will*.

'*Fifthly*, When I affirm that all matter exists in mind, or that no matter is external, I do not mean that the world, or any visible object of it, which I (for instance) see, is dependent on the mind of any other person besides myself; or that the world, or matter, which any other person sees, is dependent on mine, or any other person's mind, or faculty of perception. On the contrary, I contend as well as grant, that the world which John sees is external to Peter, and the world which Peter sees is external to John. That is, I hold the thing to be the same in this as in any other case of sensation; for instance, that of sound. Here two or more persons, who are present at a concert of music, may indeed in some sense be said to hear the *same* notes or melody; but yet the truth is, that the sound which one hears, is not the *very same* with the sound which another hears—because the souls or persons are supposed to be different; and therefore, the sound which Peter hears is external to, or independent on, the soul of John, and that which John hears is external to the soul or person of Peter.

'*Lastly*, When I affirm that no matter is altogether external, but necessarily exists in some mind or other, exemplified and distinguished by the proper names of John, Peter, &c., I have no design to affirm that every part or particle of matter, which does or can exist, must needs exist in some *created* mind or other. On the contrary, I believe that infinite worlds might exist, though not one single created, (or rather merely created,) mind were ever in being. And, as in fact there are thousands and ten thousands, I believe, and I even contend, that there is an Universe, or Material World in being, which is, at least, numerically different from every material world perceived by mere creatures. By this, I mean the great Mundane Idea of created (or rather twice created) matter, *by* which all things are produced; or rather, (as my present subject leads me to speak,) *by* which the great God gives sensations to all his thinking creatures, and by which things that are not are preserved and ordered in the same manner as if they were.

'And now I presume and hope, that my meaning is sufficiently understood, when I affirm, that all matter which exists, exists in, or dependently on, mind; or, that there is no such thing as an External World.

'Nevertheless, after all the simplicity to which this question seems already to be reduced, I find myself necessitated to divide it into two. For, in order to prove that there is no External World, it must needs be one article to shew that the *visible* world is not external; and when this is done, though in this all be indeed done which relates to any opinion yet entertained by men, yet something still is wanting towards a full demonstration of the point at large, and to come up to the universal terms in which the question is expressed.

'Accordingly, I shall proceed in this order. *First*, to shew that the visible world is not external. *Secondly*, to demonstrate more at large, or simply, that an external world is a being utterly impossible. Which two shall be the subjects of two distinct Parts or Books.'

Collier in the end resolves the difference between sense-perception and imagination into a difference in degree merely. To imagine an object is to perceive it less vividly than we perceive it in the senses. 'I can no more,' he says, 'understand

how we can create the objects we imagine than the objects we are said to see. What is imagined exists as much, to all appearance, without, or external to the mind which perceives it, as any of those objects usually called visible—*but not so vividly*; and this is that whereby I distinguish the act which we call imagination from the act which we call vision. But why is this, but because the common cause of both, viz. God, does not, in the former act, impress or act so strongly upon my mind as in the latter? If He did, both acts would become one, or require the same name; and there would be no difference between seeing and imagining[1].' So Hume afterwards. Berkeley's position in relation to the difference between actual perception and mere imagination I have elsewhere noted.

The difference is surely more than one of degree. There is a difference in kind between real existence in place, and subjective imagination, peculiar to an individual mind. Yet is not this difference consistent with the real things present in sense, and also the real place in which they exist, being alike dependent for their actual existence on living Mind—in short, with their being grounded on Knowing, and not on an abstract Unknown? May not space be the uncreated or necessary condition of the possibility of all sense-experience like ours, yet dependent for its actual existence upon living percipience?

[1] See Benson's *Memoirs of Collier*, pp. 26, 27.

C

SAMUEL JOHNSON AND JONATHAN EDWARDS

JOHNSON and Edwards are the two pioneers of philosophy in America. After his premisses have been granted, Edwards is perhaps the most acutely argumentative of modern thinkers. Johnson was an acknowledged disciple of Berkeley. Both Johnson and Edwards held a conception of the material world akin to his ; but Johnson, along with Berkeley, adopted a conception of active Causality in the universe that is different from that of Edwards.

SAMUEL JOHNSON

was born in Connecticut in 1696, graduated at Yale College in 1714, and was tutor in Yale from 1716 till 1719. He was for a short time pastor in the Congregational Church at Whitehaven, but, induced by study of Anglican divinity, he faced the opposition of his family and social surroundings, and joined the Church of England. Accordingly, in 1722 he crossed the Atlantic to receive ordination in London, and returned in the following year, as Anglican missionary at Stratford in Connecticut, where he served for more than thirty years. He may have heard of Berkeley when he was in England, and he seems in the interval to have read some of his works with sympathetic intelligence ; confirmed afterwards by personal intercourse and correspondence when Berkeley lived in Rhode Island, and by correspondence to the end of Berkeley's life. His mind had been early opened to modern thought ; for he tells that at college a new world was disclosed to him by Bacon's *Instauratio Magna*, after which he found himself like one emerging from the glamour and confusion of twilight into the full light of day. In his letters to Berkeley he proposed difficulties which seemed to be involved in the new conception of the dependent reality of the world that is presented in sense. Satisfied with the offered explanations, he reproduced the new thought in language less paradoxical than Berkeley's ; and perhaps his difficulties were not without effect in modifying its manner of expression in *Alciphron* and *Siris*. In 1754 Johnson was made President of the newly

founded College in New York, which was organized under his administration in the nine years during which he held office. After his retirement he returned to Stratford, where he died in 1772.

Johnson's philosophy is unfolded in text-books and in correspondence with Berkeley; also afterwards with Cadwallader Colden, Lieutenant-Governor of New York. As early as 1723 he published an elementary *Introduction to the Study of Philosophy*. His most important work, *Elementa Philosophica*, appeared in 1752 at Philadelphia (printed by Benjamin Franklin) and in a second edition at London, in 1754. The little book consists of two parts—*Noetica*, or things relating to the understanding, and *Ethica*, or things relating to moral behaviour. It is dedicated to Berkeley, who did not live to see it. I am indebted to Mr. Sibley, librarian at Harvard, for the use of this rare volume. The following extracts illustrate the drift of its philosophy:—

'These *ideas*, or objects of sense, are commonly supposed to be pictures or representations of things without us, and indeed external to any mind, even that of the Deity Himself; and the truth or reality of them is conceived to consist in their being exact pictures of things or objects without us, which are supposed to be the real things. But, as it is impossible for us to conceive what is without our minds, and consequently what those supposed originals are, and whether these *ideas* of ours are just resemblances of them or not, I am afraid this notion of them will lead us into an inextricable scepticism. I am therefore apt to think that these *ideas*, or immediate objects of sense, *are the real things*, at least, all that *we* are concerned with—I mean of the sensible kind; and that the *reality* of them consists in their stability or consistence, and their being, in a stable manner, exhibited to our minds, or produced in them in a steady connexion with each other, conformable to certain fixed laws of nature, which the great Father of Spirits hath established to Himself, according to which He constantly affects our minds, and from which He will not vary; unless upon extraordinary occasions, as in the case of miracles. Thus, for instance, there is a fixed, stable connexion between things tangible and things visible, or the immediate objects of touch and sight,—depending, as I conceive, immediately upon the permanent, most wise and almighty Will of the great Creator and Preserver of the world. By this, however, it is not meant that visible objects are *pictures* of tangible objects, for they are entirely different and distinct things; as different as the sound triangle, and the figures signified by it. All that can be meant by it therefore is, that, as *tangible things* are the things immediately capable of producing (or rather being attended with) sensible pleasure and pain in us, according to the present laws of our nature, on account of which *they* are conceived as being properly the real things; so, the immediate objects of sight are always, by the same stable law of our nature, connected with *them*, as signs of them, and ever correspondent and proportioned to them. . . . Not that it is to be doubted that there are Archetypes of these sensible ideas, existing external to *our* minds; but then they must exist *in some other mind*, and be *ideas* also as well as ours; because an idea can resemble nothing but an idea, and an

idea ever implies, *in* the very nature of it, relation to a mind perceiving it, or in which it exists. But then, those Archetypes or Originals, and the manner of their existence in that Eternal Mind, must be entirely different from that of their existence in our minds; as different as the manner of His existence is from ours. In Him, they must exist as in Original Intellect; in us, only by way of Sense and Imagination; in Him as Originals, in us only as faint copies; such as He thinks fit to communicate to us, according to such laws and limitations as He hath established, and such as are sufficient to all the purposes of our well-being, in which only we are concerned. Our ideas, therefore, can no otherwise be said to be images or copies of their Archetypes in the Eternal Mind, than as our souls are said to be images of Him, or as we are said to be made after His image.' (*Noetica*, chap. i. 8–10.)

The faith that living mind is the only active Cause in existence, vindicated by Berkeley on the ground of his new conception of the material world, is in like manner vindicated by Johnson, by whom, also, the sensible world is conceived as a system of constant sequences, or interpretable signs. Causation is thus explained in the *Noetica*:—

'By the word *cause* we mean a being by whose design and activity another being exists; that being which exists by the design or exertion of another is called an *effect*. An effect without a cause is a contradiction in terms. There are things that occur to the senses that appear at first sight to be agents or causes, which, strictly speaking, are not so. So we say the *sun* ripens the fruits; whereas we find, upon a more strict inquiry, that it is by no means the adequate cause. The sun and other (what we call) natural causes are in themselves passive inert beings, connected with one another according to the established laws of nature: they should therefore be called only *signs*; and we must look for some other being in whom resides that adequate power by which the effect is truely produced, and which, therefore, is the true and real cause; as the others can only be called apparent causes, having in them no real efficiency or activity,' (ch. ii. 4–7).

This position is further defended in an answer to Cadwallader Colden, who desired to be informed as to why consciousness and intelligence are essential to all agents that act from a power within themselves:—

'As it is not the part of a philosopher to multiply beings and causes without necessity, it seems plain,' Johnson replies, 'that we ought not to imagine any other principle of action than the principle of Intelligence, which we know from our own soul has in fact a power of self-exertion. . . . When we speak of the *action* of matter, we use that word for want of a better, in a sense rather figurative than literal, and understand it in a vulgar sense rather than in a strictly philosophical, as we understand the rising and setting of the sun. So we may call *writing* the *action* of the pen, when it is really merely *acted*; and consequently, by the action of matter you do not mean any exertion of its own, much less a designed, conscious self-exertion.'

Blind or impercipient sequence is, in short, not real Power, for this leaves the conception of active causation empty.

There are passages in the *Noetica* like the following, regarding an intellectual light native to the mind, which harmonize with *Siris*, and also with the Cambridge Platonists, more than with Berkeley's book of *Principles* and early *Dialogues*:—

'No sooner does any object strike the senses, or is received in our imagination, or apprehended by our understanding, but we are immediately conscious of a kind of intellectual light within us, whereby we not only know that we perceive the object, but as it stands related to all other things; and we find that we are enabled, by this intellectual light, to perceive objects and their relations in like manner as by sensible light we are enabled to perceive the objects of sense and their situations; and our minds can no more withstand the evidence of this than they can withstand the evidence of sense. Thus I am under the same necessity to assent to this—that I am or have a being, and that I perceive, and that I exert myself, as I am of assenting to this—that I see colours or hear sounds. . . . This light is also common to all intelligent beings. By it all at once see things to be true and right, in all places at the same time, and alike invariable at all times. If it be asked, whence does this light derive, whereby all created minds do at once perceive, as by a common standard, the same thing to be true and right, I answer, I have no other way to conceive how I came to be affected with this intuitive, intellectual light than by deriving it from the universal presence and action of Deity. For I know I am not the author of it myself, being passive and not active with regard to it; though I am active in consequence of it.'

The theistic or objective Idealism of Berkeley is the groundwork of the *Noetica* of Johnson.

Jonathan Edwards.

That Edwards reached a conception of the material world and its reality similar to Berkeley's, I ventured to assert, thirty years ago, in the *Life and Letters* of Berkeley. The statement has since been discussed in various aspects by eminent American thinkers. But I did not mean to assert dogmatically that Edwards got his conception of matter from Berkeley; for there was and is no positive proof of this; and I am now less disposed to that conjecture than I was then. The coincidence is interesting, but the explanation of the coincidence is obscure.

Edwards was born in 1703, at Windsor in Connecticut. He entered Yale College in 1716, and graduated four years later. In his fifteenth year he was attracted to philosophy by Locke's *Essay*. He gave early expression to his own thought in *Notes*, in which we find the germs of his philosophical system[1]. In 1724 he was tutor in Yale College; in 1726 became pastor of the Congregational Church in Northampton; from which he removed, in 1751, to Stockbridge, in Massachusetts, as missionary

[1] Published partly in the Appendix to Dwight's Memoir of Edwards.

to the Indians. Six years later he was appointed President of Princeton College in New Jersey, an office from which death removed this great religious thinker in the following year. The juvenile *Notes on Mind*, and *on Natural Science*, with his *Inquiry into the Freedom of the Will*, published in 1754, represent his metaphysical and ethical thought; supplemented by an essay on *God's End in the Creation of the World*, and a *Treatise on the Nature of True Virtue*, both of later date than the book on Free-will.

Take the following extracts from the Commonplace Book of *Notes*, in illustration of his ultimate conception of the material world:—

'When we say that the world, i. e. the material universe, exists nowhere but in the mind, we have got to such a degree of strictness and abstraction that we must be exceedingly careful that we do not confound and lose ourselves by misapprehension. It is impossible that it should be meant that all the world is contained in the narrow compass of a few inches of space, in little ideas in the place of the brain; for that would be a contradiction: for we are to remember that the human body, and the brain itself, exist only mentally, in the same sense that other things do; and so that which we call *place* is an idea too. Therefore things are truly in those places; for what we mean, when we say so, is only, that this mode of our idea of place appertains to such an idea. We would not therefore be understood to deny that things are where they seem to be. Nor will it be found that the principles we lay down shall make void natural philosophy; for to find out the reasons of things in natural philosophy is only to find out the proportion of God's acting. And the case is the same as to such acting whether we suppose the world only mental in our sense or no. . . . . Place itself is only mental; *within* and *without* are mental conceptions. When I say, the Material Universe exists only in the mind, I mean, that it is absolutely dependent on the conceptions of mind for its existence; and does not exist as Spirits do, whose existence does not consist in, nor in dependence on, the conceptions of other minds. Here we must be exceedingly careful lest we confound ourselves by mere imagination. It is from hence I expect the greatest opposition. It will appear a ridiculous thing, I suppose, that the material world exists nowhere but in the soul of man, confined within his skull; but we must again remember what sort of existence the head and brain have. The soul, in a sense, has its seat in the brain; and so, in a sense, the visible world is existent out of the mind; for it certainly, in the proper sense, exists out of the brain. . . . . Space is a necessary being, if it may be called a being; and yet we have also shewn, that all existence is mental, that the existence of all exterior things is ideal.

Take the following *argument* in support of the necessary dependence of the material world for its reality on percipient mind:—

'How doth it grate upon the mind to think that Something should be from all eternity, and yet nothing all the while be conscious of it. To illustrate this, let us suppose the world had a being from all eternity,

and had many great changes and wonderful revolutions, and all the while there was no knowledge in the universe of any such thing. How is it possible to bring the mind to imagine this? Yea, it is really impossible that it should be that anything should *exist* and nothing *know* it.... Let us suppose this impossibility—that all spirits in the universe were for a time deprived of their consciousness, and that God's consciousness was at the same time to be intermitted. I say the universe for that time would cease to be; and this not merely because the Almighty could not attend to uphold it, but because God could know nothing of it.... It follows from hence that beings which have knowledge and consciousness are the only proper and real and substantial beings; *inasmuch as the being of other beings is only by these.* From hence we may see the gross mistakes of those who think material things the most substantial things, and spirits more like a shadow; whereas spirits only are properly substance.... Hence it is manifest that there can be nothing like those things we call by the name of *bodies* out of the mind; unless it be in some other mind or minds.... That which truly is the *substance* of all bodies is, the infinitely exact and precise and perfectly stable Idea in God's mind; together with His stable Will, that the same shall gradually be communicated to us and to other minds, according to certain established methods and laws.'

He concludes, accordingly, that the material world has no independent external reality, being realised ultimately only in the mind and by the will of God.

'Since all material existence is only idea, this question may be asked—In what sense may those things be said to exist, which are supposed, and yet are in no actual idea of any created minds? I answer, they existed only in Uncreated Idea. But how do they exist otherwise than they did from all eternity; for they always were in Uncreated Idea and Divine appointment? I answer, They did exist from all eternity in Uncreated Idea, as did everything else, and as they do at present; but not in created idea. But it may be asked, How do those things exist, which have an actual existence, but of which no created mind is conscious? For instance, the furniture of this room, when we are absent, and the room is shut up, and no created mind perceives it; how do these things exist? I answer, there has been in times past such a course and succession of existences, that these things *must be supposed*, to make the series complete, according to Divine appointment of the order of things. And there will be innumerable things consequential, which will be out of joint, out of their constituted series, without the supposition of these. For, upon the supposition of these things, are infinite numbers of things otherwise than they would be, if these were not *by God* thus supposed. Yea, the whole Universe would be otherwise; such an influence have these things, by their attraction and otherwise. Yea, there must be a universal attraction, in the whole system of things, from the beginning of the world to the end—and, to speak more strictly and metaphysically we must say, in the whole system and series of ideas in all created minds;—so that these things must necessarily be put in, to make complete the system of the ideal world. That is, they must be supposed, if the train of ideas be in the order and course settled by the Supreme Mind. So that we may answer in short, that the existence of these things is in

God's supposing of them, in order to the rendering complete the series of things; (to speak more strictly, the series of ideas) according to His own settled order, and that harmony of things, which He has appointed. The supposition of God which we speak of is nothing else but God's acting, in the course and series of His exciting ideas, *as if* they (the things supposed) were in actual idea.'

Causation or Power is the supreme and ultimate conception alike with Berkeley and Edwards, but differently conceived by each. The *Inquiry into the Freedom of the Will* is a fasciculus of conclusions, articulately unfolded, all deduced from the fundamental presupposition, that 'every effect must be caused.' Now this, strictly speaking, is only a verbal truth, inasmuch as the term 'effect' involves causation in its connotation. But it does not follow that every *change* must have a *caused* cause, external to itself; so that volitions, for which the willing agent is morally responsible, must, like the agent himself, be referred to a cause that is antecedent to themselves, and external to the voluntary agent. It must not even be presumed that a so-called cause, thus dependent upon an antecedent external cause, is properly called a cause at all; for mere sequence, however constant and continuous, is not the active causation which originates, or is the *creator* of, the effect for which the agent is responsible. Mind is accordingly the one universal moving cause; matter is wholly passive or powerless; only moral agents originate change. Finite persons originate the volitions which *they* are responsible for. God originates and sustains wholly passive external nature in an unbeginning and unending evolution.

On the contrary, that persons as well as things are, even in their voluntary acts, only the passive subjects of a power that is not their own, so that God is the only real agent in existence, is the implied philosophy of Edwards; unless indeed we are to interpret it as a resolution of all supposed responsible agency, Divine as well as finite, into natural sequence, in an indefinite, if not infinite, succession, as with Hobbes, or Collins, or Hume, in which so-called divine as well as finite acts are equally subject to their antecedents, so that virtually nothing is Divine. At any rate, in this philosophy, Goodness in God seems to be superseded by Omnipotence, and moral indifference, instead of virtue or vice, is logically the characteristic of action in men and devils. 'Arbitrary' sovereignty is then attributed to God, who may abandon the wicked to their wickedness, instead of being obliged, by the perfection of His goodness, to convert the wicked from their wickedness; not for their own merits, but because their personal goodness is *an end in itself*, which forbids this arbitrariness, as inconsistent with the moral perfection, and therefore with the existence of God. Yet Edwards appears to contemplate unappalled an arbitrary

sovereignty which decrees endless and ever-increasing *wickedness* in a universe that reveals the character of the Universal Mind, whose Goodness as well as Omnipotence is man's only final guarantee for trustworthy intercourse with his surroundings, for faith alike in natural order and in miracles, as well as for the common hopes or expectations of human life. If the Universal Mind contradicts moral reason, the Universal Mind is not divine but diabolic; and even physical science, as well as supernatural religion, dissolves in nescience and despair of a universe that is radically untrustworthy, which, because it is undivine, is incapable of being reasoned about or lived in[1].

The contradiction appears in the endless existence of wicked agents in a divinely constituted universe, and in the endlessness of suffering if wicked agency is to have no end; and in this endlessness of an ever-multiplying succession of agents increasingly evil under the *arbitrary* will of Omnipotent Power. The agnostic pessimism that is latent in this final conception does not arrest Edwards, who was dominated throughout by the Spinozistic conception of God as the only Being, and therefore (so Edwards concludes) the only Power.

With a view to reconcile goodness or badness in the voluntary acts of persons with causal dependence of their volitions upon external nature, Edwards argues that goodness and badness are qualities inherent in volitions after they have been effected, so that they do not depend upon the cause in which they originate; that *I* am not the *creator* of my volitions does not accordingly make me the less accountable for them: I am still accountable for them, although *I* could not help willing them, because, after they have been willed in me, they are found to be of bad quality; while I am not the cause in which they originate, but only the passive subject in which they appear, in sequence to their antecedent natural cause. The essence of virtue and virtuous volitions is in short inherent, not in their producing cause, but in their nature, after they have been caused. A reason for this is proposed. If the wickedness of a volition lies in its originating cause, and not absolutely in its physical nature, then the wickedness of this its cause must in like manner be, not in itself, but in *its* cause, and so on *in infinitum*; which is offered as a *reductio ad absurdum*. In all which reasoning the conception of an active and morally responsible agent, absolutely and finally originative from within, is contradicted. While even Berkeley's account of morally responsible causation is imperfectly developed, the only causes recognised by Edwards are Berkeley's established natural signs, forming the divine language of which the physical

[1] This thought is expanded throughout my *Philosophy of Theism*, especially Part III.

world is the expression; emptied as merely material nature is, according to him, of all true causation, and reduced to passive sequence, determined by God. But Edwards reduces men and all persons in the universe to this category, along with material nature.

On the minor question of the indebtedness of Edwards to Berkeley for his conception of bodies as mind-dependent things, while their coincidence in thought and language is remarkable, I find no positive proof that Berkeley was known to Edwards when his *Notes* were written; and although they were not far distant from one another when Berkeley was in Rhode Island, and Edwards at Northampton, we may conclude that they never met.

Among other works in which this subject is referred to may be mentioned, Allen's *Life and Writings of Jonathan Edwards* (1889); Fisher's *Discussions in History and Theology*, 'The Philosophy of Jonathan Edwards' (New York, 1880); *Jonathan Edwards' Idealism*; and *Some Early writings of Jonathan Edwards*, A.D. 1714–24, by Egbert C. Smith (Worcester, Mass., 1896); also an article on 'The Early Idealism of Jonathan Edwards,' by Professor H. N. Gardiner, in *The American Philosophical Review* (November, 1900).

Let us hope that some one, competent philosophically, yet not out of sympathy with the profound religion of Edwards, may present the world with an edition of his published and unpublished writings, worthy of this great religious and philosophical genius, whose subtle arguments and uncriticised premisses leave ample room for editorial interpretation and criticism. It may be said of him as of Jacobi, that, like Hecla burning in Iceland, his devotional fervour resists the freezing power of the abstract argumentation in which he was so signally a master.

D

SOME OF BERKELEY'S EARLY CRITICS

THE first critical reference to Berkeley, probably on hearsay, by an eminent philosopher, is by Leibniz, in a letter to Des Bosses, dated Hanover, March 15, 1715, in which he remarks—

'Qui in Hybernia corporum realitatem impugnat, videtur nec rationes afferre idoneas nec mentem suam satis explicare. Suspicor esse ex eo hominum genere, qui per Paradoxa cognosci volunt.'

He accuses Berkeley of attacking the reality of bodies, but he complains that he does not sufficiently unfold his meaning. Yet Leibniz himself uses language akin to Berkeley, although without the express qualification involved in Berkeley's theistic or objective idealism, as when, for instance, he remarks—

'Itaque nullo argumento absolute demonstrari potest, dari corpora; nec quicquam prohibet *somnia quædam bene ordinata* menti nostræ objecta esse, quæ a nobis vana iudicantur, et ob consensum intro se quoad usum veris equivalent.' (*De Modo distinguendi Phenomena Realia ab Imaginariis.*)

Berkeley himself hardly refers to Leibniz—once in the *Commonplace Book*, and again in the *De Motu*; more too in relation to mathematics and physics than to metaphysics or theology.

Samuel Clarke, the metaphysical contemporary and correspondent of Leibniz, declined, as already mentioned, to engage in controversy, or to correspond with Berkeley, on the publication of the *Principles*; although some years later he refers to him in his *Remarks on Human Liberty*, suggesting an analogy between the proof that man is morally free, and the proof that the material world exists. (See Editor's Preface to the *Dialogues between Hylas and Philonous.*)

The earliest elaborate criticism of Berkeley is Andrew Baxter's, in 1733, in his *Inquiry*, in which he assumes that Berkeley is 'seriously persuaded that he has neither country nor parents, nor any material body, nor eats nor drinks, nor lies in a house; but that all these things are mere illusions, and have no existence but in the fancy.' He nevertheless

anticipates Reid and later critics, by presenting, as the great reason by which Berkeley 'pretends to demonstrate the impossibility of bodies,' the hypothesis that we are percipient of nothing but our own perceptions and ideas; which argument, he maintains, 'will equally shew spiritual substance to be a contradiction as well as matter.' Nor can one who accepts it—

'Ever propose, consistently with his own belief, to dispute with men; for all those ideas that are excited in him, as of beings maintaining the contrary of what he maintains, may be only ideas raised in *him* by some Spirit that hath a design to make a fool of and impose upon him. We only collect concerning the souls of sober men from the spontaneous motions and actions of their bodies; these, according to him, belong to nothing. He hath nothing but dreams when he publishes books. How doth he pretend that these dreams of his should be communicated to other beings, granting that they existed? In short, his whole enterprise proceeds upon the supposition of the reality of what he is going to confute. And thus he puts it in his adversary's power to prove from the very nature of his attempt, that he doth not believe it himself, and so to confute him without any other argument. This is the fate of the generality of Sceptics; their very design opposes and defeats itself. Thus Pyrrho pretended to give a demonstration to prove that no demonstration could be given' (vol. II. pp. 270–72).

Bishop Warburton compares Berkeley and Baxter in terms which history thus far has failed to justify:—

'Dr. Berkeley,' he says, 'was, I believe, a good man, a good Christian, a good citizen, and all in an eminent degree. He was besides very learned, and of a fine and lively imagination; which he unhappily abused by advancing, and as far as I can learn throughout his whole life persisting in, the most outrageous whimsery that ever entered into the head of any ancient or modern madman;—namely, the impossibility of the real or actual existence of matter; which he supported on principles that take away the boundaries of truth and falsehood; expose reason to all the outrage of unbounded scepticism; and even, in his own opinion, make mathematical demonstration doubtful. To this man may be eminently applied that oracle of the Stagyrite which says, "To follow Reason against the Senses is a sure sign of a bad understanding." But if (though at the expense of his moral character) we should suppose that all this was only a wanton exercise of wit, how his metaphysics came to get him the character of a great genius, unless from the daring nature of his attempt, I am at a loss to conceive. His pretended demonstration on this capital question is the poorest, lowest, and most miserable of all sophisms: that is a sophism that begs the question. As the late Mr. Baxter has clearly shewn; a few pages of whose reasoning have not only more sense and substance than all the elegant discourses of Dr. Berkeley, but infinitely better entitle him to the character of a great genius. He was truly such; and time will come, if learning ever revive among us, when the present inattention to his admirable Metaphysics, established on the Physics of Newton, will be deemed as great a dishonour to the wisdom of this age, as the neglect of Milton's poetry was to the wit of the past.'

Hume's eloge on Berkeley in 1739 was followed in 1748 by references in his *Inquiry*, to one of which he adds the following note in the Appendix:—

'This argument is drawn from Dr. Berkeley; and indeed most of the writings of that very ingenious author form the best lessons of scepticism which are to be found either among the ancient or modern philosophers, Bayle not excepted. He professes, however, in his title-page (and undoubtedly with great truth) to have composed his book against the sceptics, as well as against the atheists and free-thinkers. But that all his arguments, though otherwise intended, are in reality merely sceptical, appears from this, *that they admit of no answer, and produce no conviction.* Their only effect is to cause that momentary amazement and irresolution and confusion, which is the result of scepticism.'

On the faith of this one-sided sceptical interpretation, Berkeley has been regarded as the intellectual father of the Scottish speculative sceptic.

Accordingly, in 1764 Reid writes thus in his *Inquiry*:—

'What if these profound disquisitions into the first principles of human nature do naturally and necessarily plunge a man into this abyss of scepticism? May we not reasonably judge so from what hath happened? Descartes no sooner began to dig in this mine than scepticism was ready to break in upon him. He did what he could to shut it out. Malebranche and Locke, who dug deeper, found the difficulty of keeping out this enemy still to increase; but they laboured honestly in the design. Then Berkeley, who carried on the work, despairing of securing all, bethought himself of an expedient. By giving up the material world, which he thought might be spared without loss and even with advantage, he hoped, by an impregnable partition, to secure the world of spirits. But alas! the *Treatise of Human Nature* wantonly sapped the foundation of this partition, and drowned all in one universal deluge.' (Introduction, sect. VII.)

Yet Reid himself, according to his own account, in early life accepted all Berkeley's philosophy (as he interpreted it), and at the end of his life argued for the powerlessness of mere matter and the exclusive active causality of Mind; but without resting this on that view of the material world which alone had opened the way for Berkeley to *his* conception of All, as finally grounded in living Reason and Will. His philosophy, increasingly in the *De Motu*, *Alciphron*, and *Siris*, is a reasoned recognition of Spiritual Power universally at work; negation of the absolute independence of Matter leading the way to this. Reid fails, I think, to see the drift of the New Question with which Berkeley is inspired in his *Commonplace Book* and throughout his life.

Take the following caricature of Berkeley by Beattie as another example of the early critics:—

'A great philosopher has actually demonstrated—we are told—that

Matter does not exist. Truly this is a piece of strange information. At this rate any falsehood may be proved to be true, and any truth to be false. For it is impossible that any truth should be more evident to me than this—that Matter *does* exist. . . . . Till the frame of my nature be unhinged, and a new set of faculties given to me, I cannot believe this strange doctrine, because it is perfectly incredible. But if I were permitted to propose one clownish question, I would fain ask—Where is the harm of my continuing in my old opinion, and believing, with the rest of the world, that I am not the only created being in the universe, but that there are many others, whose existence is as independent on me as mine is on them? Where is the harm of my believing that if I were to fall down yonder precipice and break my neck, I should be no more a man of this world? My neck, sir, may be an *idea* to you, but to me it is a *reality*, and an important one too. Where is the harm of my believing that if, in this severe weather, I were to neglect to throw (what you call) the *idea* of a coat over the *ideas* of my shoulders, the *idea* of cold would produce the *idea* of such pain and disorder as might possibly terminate in *real* death? What great offence shall I commit against God or man, church or state, philosophy or common sense, if I continue to believe that material food will nourish me, though the idea of it will not; that the real sun will warm and enlighten me, though the liveliest idea of him will do neither; and that if I would obtain true peace of mind and self-approbation, I must form not only ideas of compassion, justice, and generosity, but also really exert these virtues in external performance? What harm is there in all this? . . . I never heard of any doctrine more scandalously absurd than this of the non-existence of Matter. There is not a fiction in the *Persian Tales* that I would not as easily believe; the silliest conceit of the most contemptible superstition that ever disgraced human nature is not more shocking to common sense. . . . If a man professing this doctrine act like other men in the common affairs of life, I will not believe his profession to be sincere.

'But if a man be convinced that Matter has no existence, and believe this strange tenet as steadily as I believe the contrary, he will have, I am afraid, but little reason to applaud himself in this new acquisition in science. If he fall down a precipice, or be trampled under foot by horses, it will avail him little that he once had the honour to be a disciple of Berkeley, and to believe that those dangerous objects are nothing but ideas in his mind. . . . What if all men were in one instant deprived of their understanding by Almighty Power, and made to believe that Matter has no existence but as an idea in the mind? Doubtless this catastrophe would, according to our metaphysicians, throw a wonderful light on all the parts of knowledge. But of this I am certain, that in less than a month after there could not, without another miracle, be one human creature alive on the face of the earth. . . . This candle it seems hath not one of those qualities it appears to have: it is not white, nor luminous, nor round, nor divisible, nor extended; for to an idea of the mind not one of these qualities can possibly belong. How then shall I know what it really is? From what it seems to be, I can conclude nothing; no more than a blind man, by handling a bit of black wax, can judge of the colour of snow, or the visible appearance of the starry heavens. The candle may be an Egyptian pyramid, or the king of Prussia, a mad dog, or nothing at all, for anything I know, or can ever

know to the contrary; except you allow me to judge of its nature from its appearance; which, however, I cannot reasonably do, if its appearance and nature are in every respect so different and unlike as not to have one single quality in common. I must therefore believe it to be, what it appears to be, a *real* corporeal, external object—and so reject Berkeley's system. . . . This system leads to Atheism and universal scepticism. . . . . Suppose it universally and seriously adopted; suppose all men divested of all belief, and consequently of all principle: would not the dissolution of society, and the destruction of mankind, ensue? . . . . . It is a doctrine according to which a man could not act nor reason in the common affairs of life without incurring the charge of insanity and folly, and involving himself in distress and perdition. . . . From beginning to end it is all a mystery of falsehood, arising from the use of ambiguous words, and from the gratuitous admission of principles which could never have been admitted, if they had been thoroughly understood.' (*Essay on Truth*, vol. I. pp. 242-60.)

When our English Samuel Johnson wanted to refute Berkeley, his refutation was to strike his foot against a stone. According to Voltaire, ten thousand cannon balls and ten thousand men were only ten thousand ideas for Berkeley. There is as much humour in the Irish myth of Berkeley's visit to Swift on a rainy day. By the Dean's order, he was left to stand before the unopened door, because, on his principles, it was assumed that he could as easily enter the house with the door shut as with the door open.

It is hardly necessary to illustrate the critical treatment of Berkeley by Stewart and Brown in Scotland, or by other philosophers in the end of the eighteenth and in the early part of the nineteenth century; in all which he appears as the sceptic, in a scepticism that is attributed to his supposed acceptance of the prevailing assumption of philosophers—that the real external world is imperceptible; that reality makes no appearance; so that each person is self-contained, imprisoned within the universe of his own subjective, transitory fancies, which *per se* offer no ground for faith in any outstanding realities behind. With which negations English empiricism under Hartley and Mill was sympathetic, but it went to form the *bête noire* of those Scottish philosophers of Common Sense who struggled against what they called 'the ideal theory.'

Reid and (more articulately) Hamilton repel the hypothesis of a self-contained intelligence, to which other reality is imperceptible, in favour of the common-sense conviction that 'the real world' is consciously presented to us in sense, without this supposed inevitable *intermedium* of 'ideas,' interpreted as mere fancies. But they do not criticise Berkeley on his own terms, which make *his* world of sense-ideas very different from the arbitrary subjective fancies attributed to him. For his is a world presented to us in and according to the constant providential activity of perfect Reason in God—a world of objects that

are not mere fancies—yet called *ideas*, because argued to be inevitably dependent on realising mind for their actual concrete reality; not separated from our percipient consciousness by any medium, but immediately presented in this reality; though not so as to embrace exhaustively the infinite universe of relations and related things that is perfectly comprehensible only in Omniscience.

Reid and Hamilton, in short, are at one with Berkeley in acknowledging that matter is immediately present in sense, in its concrete reality: they differ from him in the account they give of what this concrete reality is. According to Berkeley it is *mind-dependent reality*, which needs living mind to make it real: according to the Scottish metaphysicians its reality is assumed to be *independent* of all minds in existence; not my mind only, to which, according to Berkeley, it is practically external and independent. Berkeley recognises that we are face to face with material reality in sense, by treating as empty abstraction or negation a supposed real material world *behind* the world to which we are face to face in sense; and by vindicating the application of the terms 'reality,' 'real thing,' and 'matter' to the presented appearance. The Scottish metaphysicians, with a like motive, adopt the other alternative. Instead of surrendering a reality behind appearances, and accepting what appears in dependence on living mind as the reality, they regard the appearances as unreliable ideas, and sturdily affirm that in sense we are percipient of an object that is independent of living mind. If external things are perceived immediately, we have, according to Reid and Hamilton, the same reason to believe in *their* existence that those who assume that we can only perceive ideas have for the existence of their *ideas*. But the supposed ideas are themselves the real things—*significant* ideas, under Berkeley's conception—undergoing realisation in and through the agency of percipient mind on which they thus depend; and no other real material world is conceivable, or could be of any practical importance to us [1].

Although French versions of the *Dialogues*, *Alciphron*, and *Siris* had appeared before the middle of the eighteenth century, and Berkeley's account of vision was favourably received among the French encyclopædists, only the medicinal portion of *Siris* was translated into German. The first German translation of the *Principles* was by Ueberweg, in 1869, but the first German version of the *Dialogues* appeared in 1756. It seems that till within the latter part of the nineteenth century Berkeley has not received serious treatment in Germany, being summarily

[1] Hamilton's 'consciousness of matter' is discussed in Grote's *Exploratio Philosophica*, Part I, a work charged with profound thought.

dismissed as an incoherent and unfruitful subjective idealist, charged with philosophical scepticism.

Kant seems to have interpreted Berkeley in this fashion, treating his last word as if it were negation of the surrounding world, instead of affirmation of the reality of the sensible universe as a continuous evolution of significant signs, expressive of Divine Thought and Will. Accordingly, to avoid the charge of subjective idealism, in which things are only modifications of my individual mind, leaving the percipient alone in existence, he changed his point of view, in the second edition of the *Kritik d. r. Vernunft*, by an explicit assumption of the independent existence of things *per se*, as the real cause of those affections in us out of which we construct our perceptions and physical science; things themselves being unperceived, and only their effects in us composing experience.

But Berkeley's ideas of sense are not mere *modifications* of percipient mind. Even so early as the publication of the *Principles* Berkeley protests against 'real ideas' being taken for 'modifications' of individual mind. Thus (sect. 2) he declares that 'the perceiving active being' called 'mind, spirit, soul, or myself' does not 'denote any one of my ideas, but a thing entirely distinct from them, wherein they exist, or, which is the same thing, whereby they are perceived; for the existence of a *thing* consists [not in perceiving, but] in being perceived.' Again, in reply to the objection, that if extension and figure [extended and figured things] exist only in the mind [i. e. depend for their reality upon a realising mind], it must follow 'that the mind is extended and figured; since extension is a mode or attribute, which is predicated of the subject in which it exists.' To which Berkeley replies thus[1]:—'Those qualities are *in the mind*, not by way of *mode* or *attribute*, but only by way of *idea*[2]; and it no more follows that the soul or mind is extended, because extension exists [i. e. is real] in it alone, than it does that it is red or blue, because those colours are on all hands acknowledged to exist in it' [i. e. to be dependent on it]. In short, Berkeley's sense-ideas and sensible world are not modifications of the percipient self, but are appearances presented to the percipient self, realised thus for the percipient self, but finally referable to, and dependent on, God, or Divine Active Thought, in which the universe consists. 'I have no objection,' he says, in one of his letters to Johnson, 'against calling the Ideas in the mind of God archetypes of ours. But I object against those archetypes by philosophers supposed to be real things, and to have an absolute rational existence distinct from being perceived [realised or made real] *by any mind whatsoever*.' In Divine Omniscience,

[1] *Principles*, sect. 49.

[2] Note this explanation of what he intends by 'existence *in mind*,' a unique conception altogether.

one might add, finite mind only participates; and this ultimately in and through Faith, or incompleted knowledge.

Kant tried to go deeper than Hume, in order to restore knowledge and belief, on the basis, not of transient 'impressions,' but of thought in its necessary universality. Sensations and their supposed customs, followed by a useful habit of expectation—expectation, blind in the end, but as 'reasonable' as man is fit for—this, I think, is, on the whole, Hume's account of knowledge and existence. But this does not recognise, in Kant's insight, the necessary implicates of the experience which it pretends to give the last account of. There is an element of *genuine* necessity and universality wrapped up within experience. In this omitted element Kant finds the explanation of externality and science. Without this omitted universality and necessity he can see no possible outness: science dissolves into isolated sensations: it becomes shifting feeling. Objectivity requires purely intellectual relations, even in our very sense-experience; and this Hume had overlooked. Accordingly, the work of Kant's life was to *explain* the coherence of the universe, and yet to retain room for man's moral freedom from natural necessity. A scholastically elaborated substitution of *intellectual* instead of *customary* coherence is Kant's contribution in the reactionary succession to Hume. Kant's experience, like Hume's and Berkeley's, takes sensuous phenomena for its matter; yet its form or coherence is derived not from mere Custom—which is another name for the darkness of ignorance—but from universalising Thought. Experience is thus professedly analysed into *meaning*, instead of being thrown back upon the *unintelligible*. It is shewn to be intellectually impossible for any experience to arise in which there are no universalising principles of connexion latent. We find proof that this is so when we try to dispense with them. We find, for instance, that changing sensations cannot conceivably become experience, unless they are referred to a principle of permanence called Substance; and we also find that changes of any sort cannot become part of experience, except as they are conceived to be dependent on preceding conditions, which conditions we call their Cause. This sort of substantiality and causality, too abstract for Berkeley, is thus argued to be involved in experience, which is therefore not blindly or accidentally formed, by the custom of each man's particular experience, in a finally inexplicable mortal life.

Later German philosophy goes on to articulate these (and other) intellectual conditions as pervading all possible experience, in every department of human life; forming the Absolute Essence of the universe, in which, as intellectual, *we* participate. With Plato, too, in a long past age, the Universal was the only reality, and the particular phenomenon was real only by participation in the Universal—by unity in Intelligence. Berkeley came very

much to this in *Siris*; but, in his early philosophy, war against abstract ideas sometimes seems to make the empirical data of sense the only reality; and his tendency to test everything by concrete matter of fact, keeps in the background those Notions of the Mind, that—

> 'immutably survive,
> For our support, the measures and the forms
> Which an abstract intelligence supplies;
> Whose kingdom is, where time and space are not.'

It was the dependence of external reality upon Sense, rather than the dependence of all reality upon Universalising Thought, that he at first insisted on.

It is more difficult to compare the concrete spiritual philosophy of Berkeley with the very different point of view which later German philosophy occupies. German speculation, in Kant and in Hegel, in articulating what Berkeley left vague, professes to advance beyond his matter of fact and human philosophy. Grant that it has substituted an intellectually coherent universe for Hume's habit of expectation blindly generated by custom. In doing so, it has given the Reason to which all actual experience (if there happens to be any) must conform, and under which it must all be concatenated. But why does the concrete world, which is rationally coherent, start into concrete existence at all; why do *we* begin to exist as persons percipient of it? What set the movement going, which must be constituted under those uncreated necessary relations; and what keeps it going?

The Hegelian might perhaps answer, This is asking what set God going, and what keeps God in active thought. The intellectual necessities of Being constitute the Divine essence, shared in by Nature and finite persons. But it may still be asked, What of the 'contingencies' in existence? Why are sensible things composed of five kinds of sensation rather than of five hundred; and why am I *myself*, and not some other person, or not absorbed in the Supreme Unity? The philosophy which critically unfolds the web of necessary thought, even if it successfully unravels that web, and enables us to see the universe necessarily coherent in *its* coherency, although by its implication Omniscient, still leaves unsettled chief questions which the universe presses upon us, when the universe is looked at from the human and ethical point of view—especially the moral character of God, and the final destiny of men. Kant's criticism of pure understanding, thrown in among the 'impressions' of Hume, gives only abstract intellectual coherence.

Berkeley's philosophy is more human than this, while less intellectually thorough. Presumption of moral, and therefore free, agency is obscurely involved in his philosophy of nature from the first: without it his world would dissolve in subjective

sensation. As he leads, I am aware even in sense that the data of sense are not ultimately subject to me, and that I am not wholly subject to them. The phenomena which we perceive are discerned to be ours, so far as they need sense-percipiency; yet not ours, for *we* are not responsible for their appearance, as we are for our own volitions. Things of sense are ultimately outside our personal responsibility. The antithesis of sensibility and moral agency, which we find in Kant at last, runs, in an indistinct and fluctuating way, through Berkeley from the beginning. He in his own way combines the sensibility and the free-will of Kant—the 'matter' given to pure reason, and the moral presupposition of practical reason. Sensuous perception in Berkeley uncritically envelops Sensibility, and Moral Reason. Kant's categories of understanding and regulative ideas of reason are latent in Berkeley's early theistic sensationalism; more explicitly in his contrast, in *Siris*, between mere Sense and Reason. But in Berkeley there is no critically justified necessity for causal connectedness, or for substantial permanence; no attempt to elaborate the constitution of our experience and of existence in its universality n Thought.

E

An Essay 'Of Infinites' by Berkeley

After this edition of Berkeley's Works was printed, and when it was about to issue from the press, there appeared in *Hermathena*, No. XXVI (1900), a hitherto unpublished Essay *Of Infinites*, in Berkeley's handwriting, discovered by Professor S. P. Johnston[1] in the Library of Trinity College, Dublin, which had escaped me when I was collecting materials there for my *Life and Letters* of Berkeley in 1870. By the kind permission of the editor of *Hermathena*, I am enabled to include it in this edition of Berkeley's Works.

According to Professor Johnston, it is one of two Essays by Berkeley, contained in a miscellaneous collection of manuscripts known as the 'Molyneux Papers,' of various dates from the middle of the seventeenth to the middle of the eighteenth century, which are preserved in the Library of Trinity College. Among them are contributions to the proceedings of the Dublin

[1] Professor of Moral Philosophy in the University of Dublin.

Philosophical Society, which was founded in 1683 by William Molyneux, the friend of Locke, who was its first secretary; an office in which he was succeeded by his son Samuel (the pupil and friend of Berkeley) in 1707, when the Society was revived, after an interval of suspended animation which followed the death of his father in 1698.

The other of the two Essays is a *Description of the Cave of Dunmore, near Kilkenny*, which is virtually identical with that appended to the *Commonplace Book*, as given in the fourth volume of this edition of the Works. The version found by Professor Johnston among the 'Molyneux Papers' is dated January 10, 1705-6. Now in the *Life and Letters* of Berkeley (p. 23) I have mentioned that in 1705-6 he was engaged with some of his college friends in forming a Society for promoting research in the spirit, and according to the experimental methods, of the 'New Philosophy' of Boyle, Newton, and Locke. The first meeting seems to have been held on January 10, 1706, the date of the paper on the Dunmore Cave. Accordingly, this paper may have been a contribution by Berkeley at the inaugural meeting of this Society, which was probably the precursor of the revived Dublin Society of 1707.

The tractate *Of Infinites* is undated, but internal and external evidence would refer it to this same period in Berkeley's life, i.e. 1705 or 1706, when we have other proof that he was much occupied in mathematical studies, including the metaphysics of quantitative infinity in space and time, and infinite divisibility. The interest of the Essay is chiefly biographical. It has much in common with the *Analyst*, published nearly thirty years later, and it may be compared with the *Principles*, secs. 123-34, also the Introduction, sec. 2. But the analogy between mysteries at the root of mathematical analysis, and mysteries as involved in the religious conception of the universe, the leading thought in the *Analyst*, makes no appearance in this slight juvenile fragment, which is interesting as the earliest extant expression of Berkeley in metaphysics, except perhaps portions of his *Commonplace Book*. And of course there is no recognition of the ulterior principle (unrecognised by Berkeley to the end) that Omnipotent Goodness in the Universal Mind is (consciously or unconsciously) necessarily presupposed in our reliance on experience and natural order, in a non-omniscient knowledge like the human, which inevitably merges in mysterious incompleteness at last.

Of Infinites

Tho' some mathematicians of this last age have made prodigious advances, and open'd divers admirable methods of investigation unknown to the ancients, yet something there is

in their principles which occasions much controversy and dispute, to the great scandal of the so much celebrated evidence of Geometry. These disputes and scruples, arising from the use that is made of quantitys infinitely small in the above mentioned methods, I am bold to think might easily be brought to an end by the sole consideration of one passage in the incomparable Mr. Locke's *Treatise of Humane Understanding*, b. 2. ch. 17, sec. 7, where that authour, handling the subject of infinity with that judgment and clearness which is so peculiar to him, has these remarkable words :—

'I guess we cause great confusion in our thoughts when we joyn infinity to any suppos'd idea of quantity the mind can be thought to have, and so discourse or reason about an infinite quantity, viz., an infinite space or an infinite duration. For our idea of infinity being, as I think, an endless growing idea, but the idea of any quantity the mind has being at that time terminated in that idea, to join infinity to it is to adjust a standing measure to a growing bulk ; and, therefore, I think 'tis not an insignificant subtilty if I say we are carefully to distinguish between the idea of infinity of space and the idea of space infinite.'

Now if what Mr. Locke says were, *mutatis mutandis*, apply'd to quantity infinitely small, it would, I doubt not, deliver us from that obscurity and confusion which perplexes otherwise very great improvements of the Modern Analysis. For he that, with Mr. Locke, shall duly weigh the distinction there is betwixt the infinity of space and space infinitely great or small, and consider that we have an idea of the former, but none at all of the latter, will hardly go beyond his notions to talk of parts infinitely small, or *partes infinitesimae* of finite quantitys, and much less of *infinitesimae infinitesimarum*, and so on. This, nevertheless, is very common with writers of fluxions or the differential calculus, &c. They represent, upon paper, infinitesimals of several orders ; as if they had ideas in their minds corresponding to those words or signs, or as if it did not include a contradiction that there should be a line infinitely small, and yet another infinitely less than it. 'Tis plain to me we ought to use no sign without an idea answering it : and 'tis as plain that we have no idea of a line infinitely small, nay, 'tis evidently impossible there should be any such thing ; for every line, how minute soever, is still divisible into parts less than itself ; therefore there can be no such thing as a line *quavis data minor* or infinitely small.

Further it plainly follows that an infinitesimal even of the first degree is merely *nothing*, from what Dr. Wallis, an approv'd mathematician, writes at the 95th proposition of his *Arithmetic of Infinites*, where he makes the asymptotic space included between the two asymptotes and the curve of an hyperbola to be in his stile a *series reciproca primanorum*, so that the first term of the series, viz., the asymptote, arises from the division of 1 by 0. Since, therefore, unity, i. e. any finite line divided by 0,

gives the asymptote of an hyperbola, i. e. a line infinitely long, it necessarily follows that a finite line divided by an infinite gives 0 in the quotient, i. e. that the *pars infinitesima* of a finite line is just nothing. For by the nature of division the dividend divided by the quotient gives the divisor. Now a man speaking of lines infinitely small will hardly be suppos'd to mean nothing by them, and if he understands real finite quantitys he runs into inextricable difficultys.

Let us look a little into the controversy between Mr. Nieuentiit and Mr. Leibnitz. Mr. Nieuentiit[1] allows infinitesimals of the first order to be real quantitys; but the *differentiae differentiarum* or infinitesimals of the following orders he takes away, making them just so many noughts. This is the same thing as to say the square, cube, or other power of a real positive quantity is equal to nothing; which is manifestly absurd.

Again Mr. Nieuentiit lays down this as a self evident axiom, viz., that betwixt two equal quantitys there can be no difference at all, or, which is the same thing, that their difference is equal to nothing. This truth, how plain soever, Mr. Leibnitz sticks not to deny, asserting that not onely those quantitys are equal which have no difference at all, but also those whose difference is incomparably small. *Quemadmodum* (says he) *si lineae punctum alterius lineae addas quantitatem non auges.* But if lines are infinitely divisible, I ask how there can be any such thing as a point? Or granting there are points, how can it be thought the same thing to add an indivisible point as to add, for instance, the *differentia* of an ordinate in a parabola; which is so far from being a point that it is itself divisible into an infinite number of real quantitys, whereof each can be subdivided *in infinitum*, and so on, according to Mr. Leibnitz. These are difficultys those great men have run into, by applying the idea of infinity to particles of extension exceeding small, but real and still divisible.

More of this dispute may be seen in the *Acta Eruditorum* for the month of July, A. D. 1695, where, if we may believe the French author of *Analyse des infiniment petits*, Mr. Leibnitz has sufficiently established and vindicated his principles. Tho' 'tis plain he cares not for having 'em call'd in question, and seems afraid that *nimia scrupulositate arti inveniendi obex ponatur*, as if a man could be too scrupulous in Mathematics, or as if the principles of Geometry ought not to be as incontestable as the consequences drawn from them.

There is an argument of Dr. Cheyne's, in the 4th chapter of his *Philosophical Principles of Natural Religion* which seems to make for quantitys infinitely small[2]. His words are as follows :—

'The whole abstract geometry depends upon the possibility of infinitely

[1] Bernard Nieuwentyt. See *Siris*, sec. 190, note.

[2] Cheyne is mentioned in the *Commonplace Book*. *The Philosophical Principles of Natural Religion* appeared in 1705.

great and small quantitys, and the truths discover'd by methods which depend upon these suppositions are confirm'd by other methods which have other foundations.'

To which I answer that the supposition of quantitys infinitely small is not essential to the great improvements of the Modern Analysis. For Mr. Leibnitz acknowledges his *Calculus differentialis* might be demonstrated *reductione ad absurdum* after the manner of the ancients; and Sir Isaac Newton, in a late treatise, informs us his method of Fluxions can be made out *a priori*, without the supposition of quantitys infinitely small.

I can't but take notice of a passage in Mr. Raphson's treatise *De Spatio Reali seu Ente Infinito*, chap. 3, p. 50, where he will have a particle infinitely small to be *quasi extensa*[1]. But what Mr. Raphson would be thought to mean by *pars continui quasi extensa* I cannot comprehend. I must also crave leave to observe that some modern writers of note make no scruple to talk of a sphere of an infinite radius, or an equilateral triangle of an infinite side, which notions if thoroughly examin'd may perhaps be found not altogether free from inconsistencys.

Now I am of opinion that all disputes about infinites would cease, and the consideration of quantitys infinitely small no longer perplex Mathematicians, would they but joyn Metaphysics to their Mathematics, and condescend to learn from Mr. Locke what distinction there is betwixt *infinity* and *infinite*[2].

[1] Berkeley refers to Raphson in the *Commonplace Book*, and also in one of his letters to Samuel Johnson.

[2] See the annotations in my edition of Locke's *Essay*, Bk. II, ch. 17 (Oxford, 1894).

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